FACTORS CONTRIBUTING TO THE PREVALENCE OF PROSTATE CANCER IN RURAL SASKATCHEWAN: THE SASKATCHEWAN RURAL HEALTH STUDY

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ABSTRACT

Prostate cancer is the most commonly diagnosed cancer in Canadian males, and is the third most common cause of cancer related deaths with decreasing mortality in men. Previous studies have suggested that an increased risk of prostate cancer among men may be associated with rural environment. The etiology of prostate cancer is not precisely known among men in rural Saskatchewan. We investigated the prevalence of prostate cancer and the putative relationship between rural exposures (occupational i.e. farming and environmental), personal smoking history, family history of cancer and prostate cancer. A baseline mail out survey was conducted in 2010-2011 of 11,982 households located in four geographic regions (South West, South East, North West, and North East) of Saskatchewan, Canada. Completed questionnaires were obtained from 4,624 households (8,261 individuals).The questionnaires collected information on individual (demographic factors, exposure to pesticides including insecticides, herbicides and fungicides) and contextual (household characteristics such as income, smoking) determinants from a rural population. In total 2,938 males (114 prostate cancer cases) were included for this analysis who were older than 45 years. Logistic regression analysis was used to analyze the relationship between independent variables and prostate cancer. Among prostate cancer cases, 46% of men lived on farms of rural Saskatchewan. The age standardized prevalence of prostate cancer was 3.32% (3.81% (n=52) and 2.95% (n=61) among farm and non-farm resident men). Farming job and farming duration did not have a statistically significant association with prostate cancer. A trend was observed for men who had work place exposure to insecticides and fungicides collectively and radiation to have an increased risk in comparison to men without these exposures. Personal smoking history, history of smoking pack years and family history of cancer modified the relationship between residence and prostate cancer. Age of an individual ($\geq$ 65 years) was the strongest and most consistent risk factor of prostate cancer. Other factors such as marital status, household income adequacy, history of cardiovascular disease may also be associated with prostate cancer. The results may help research professionals by directing the focus of their research towards rural population examining prostate cancer.

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LIST OF ABBREVIATIONS

SRHS- Saskatchewan Rural Health Study

PSA- Prostate Specific Antigen

DRE- Digital Rectum Exam

HL- Hosmer and Lemeshow

DNA- Deoxyribonucleic Acid

UV- Ultraviolet

US- United States

NPHS- National Population Health Survey

ASR- Age Standardized Rates

OR- Odds Ratio

CI- Confidence Interval

d.f.- degree of freedom

R- Relative Risk

χ^2- Chi-Square

α – Level of Significance

$\hat{\beta}$- Sample Estimate

CHAPTER 1: INTRODUCTION AND RATIONALE

1.1 Introduction

Prostate cancer starts in the cells of the prostate gland which is a part of the male reproductive system and can also spread to nearby organs. Prostate cancer usually grows slowly and can be detected early using a Prostate Specific Antigen (PSA) test and a Digital Rectal Exam (DRE) (1). Due to widespread use of PSA testing the incidence rates of prostate cancer has increased since 1980 (2). Cancer is a leading cause of death worldwide, accounting for 7.6 million deaths (around 13% of all deaths) in 2008 (3). Out of all cancer types, the second most frequently diagnosed cancer among men is prostate cancer (899,000 new cases, 13.6% of the total) and overall it is the fifth most common cancer (4). As cited by Ellison and Wilkins, in Canada, the newly diagnosed cancer cases continue to rise (5). Prostate cancer is the most commonly diagnosed cancer in Canadian males, and is the third most common cause of cancer related deaths with decreasing mortality in men (2). In Saskatchewan men, it was the most frequently diagnosed type of cancer in 2012 (6). According to the Canadian Cancer Society, an estimated 26,500 cases of prostate cancer were diagnosed and 4,000 deaths from prostate cancer were reported in the year 2012 in Canada. On average, it was estimated that every day, 73 Canadian men were diagnosed with prostate cancer and 11 died of it (2).

In 2000, Grover et al projected that (i) in the 1997 cohort of 5.8 million Canadian men between 40 and 80 years old (non-cases), prostate cancer would be diagnosed in 12.1% of Canadian men over their life-time and would be fatal in 3% to 4% cases and (ii) lifetime costs of care will total $9.76 billion (7). They also estimated a total cost of $286 million to be annually associated with treating prostate cancer in this cohort in 2022. The burden of the prostate cancer is also substantial in the province of Saskatchewan. Of all the estimated new cases of various types of cancers diagnosed in Saskatchewan, prostate cancer has the highest proportion of estimated new cases (8).

Despite its high morbidity, the etiology of prostate cancer remains obscure. So far, the risk factors associated with the development of prostate cancer are advancing age, race and a positive family history of prostate cancer (9-11). Some of the suspected putative risk factors include diet (12-14), farming occupation (9, 15-18) occupational exposures to pesticides (19-23)

wood dust (24-25) grain dust (24-25) and asbestos dust (24-25), personal smoking history (26-32) and hormones (33-35).

Farming is considered to be the major occupation of rural populations. In an epidemiologic review conducted by Parent and Siemiatycki, authors suggested that occupation and its related exposures are important to consider when investigating the potential risk for cancer (15). So far, some of the literature has indicated an association between farming and its exposure to pesticides at workplace and prostate cancer (17, 19-23). In an Australian study, a statistically significant increased risk in prostate cancer mortality was observed among men living in rural areas compared with urban areas (36). The pathogenesis of prostate cancer reflects complex interactions between environmental and genetic factors (9). Given the inconsistent evidence of risk factors (9), more research is needed to identify the potential risk factors of prostate cancer.

We propose to address the aforementioned gaps by building on and improving knowledge on prevalence and risk factors of prostate cancer among rural Saskatchewan men. We will investigate farming, as it is the major occupation of rural populations and will help us identify if farming occupation and farming related occupational exposures such as pesticides are associated with prostate cancer. We will accomplish this by using data from the Saskatchewan Rural Health Study (SRHS) which surveyed rural dwellers from across Saskatchewan in the year 2010-2011.

1.2 Rationale

In the year 2012, in the Saskatchewan male population, prostate cancer was the most commonly diagnosed cancer and was the second most frequent cause of cancer related mortality (6). The proportion of rural population of Saskatchewan is 35% (37) which is greater than the proportion of rural population of Canada (20%) (38). There is a paucity of literature on epidemiology and patterns of prostate cancer among rural dwelling men of Saskatchewan. It is important to consider rural exposures as potential risk factors of prostate cancer because of the large proportion of rural dwellers in Saskatchewan. Saskatchewan has a high proportion of rural dwellers whose major occupation is farming. Therefore, by implication it could have a potential link between prostate cancer and exposure to pesticides among rural Saskatchewan men. Investigating farming occupation and its work related exposures to insecticides, herbicides and fungicides can provide a key in understanding its association with prostate cancer in this Saskatchewan rural cohort. The literature calls for more research to investigate the prevalence,

incidence and risk factors of this important type of cancer. Also, identifying the risk factors for prostate cancer will help direct investigation into the underlying etiology of prostate cancer and help focus future prevention efforts.

1.3 Objectives

Overall Objective: To determine the prevalence and risk factors of prostate cancer among rural dwelling men older than 45 years living in Saskatchewan.

In order to accomplish the overall objective, I will undertake the following specific research questions.

Research Question 1:

"What is the prevalence of prostate cancer in rural farm and non-farm dwelling men older than 45 years of Saskatchewan in 2010-2011?"

Research Question 2:

2 (a) "Is there an association between rural exposures (occupational i.e. farming and environmental), household musty smell and pesticide application and prostate cancer in rural dwelling men of Saskatchewan?"

2 (b) "Is there an association between personal smoking history, exposure to household smoke and prostate cancer in rural dwelling men of Saskatchewan?"

2 (c) "Is there an association between age, family history of cancer and prostate cancer in rural dwelling men of Saskatchewan?"

Research Question 3:

"Is family history of cancer an effect modifier in the relationship between rural exposures (occupational i.e. farming and environmental) and prostate cancer in rural dwelling men of Saskatchewan?"

CHAPTER 2: LITERATURE REVIEW

2.1 Identification of Literature

The purpose of the current study was to determine the prevalence and risk factors associated with prostate cancer among rural Saskatchewan men. The following literature review includes a description of the epidemiology of prostate cancer, mortality and incidence rates worldwide as well as specific to Canada and Saskatchewan; and its well established and suspected risk factors. The whole search was conducted using Medline database and Google scholar. The search included articles from 1991 to 2013 and was completed in the month of July, 2013. Additional literature searches were completed periodically in order to update the article lists. Search terms or keywords included but were not limited to "prostate cancer", "risk factors", "epidemiology", "rural", "pesticides", "fungicides", "herbicides", "insecticides", "family history", "smoking" and "farming". Combinations of these terms were used to explore the literature. This literature review was limited to publications in the English language and in relation to human studies only.

2.2 Incidence and Mortality

2.2.1 International

The international patterns in prostate cancer incidence and mortality rates vary hugely. According to the GLOBOCAN cancer fact sheet (4), worldwide in the year 2008, it was the second most common cancer diagnosed among men (899,000 new cases, 13.6% of the total). Almost 75% (i.e. 644,000) of the registered cases of prostate cancer arise in developed countries (4). A review conducted by Baade et al (39) confirmed that prostate cancer was prevalent in more developed nations such as the United States of America (USA) and the Scandinavian countries. The incidence rates in the USA (approximately 105 per 100,000) were more than twice those in Australia (approximately 52 per 100,000) and in Europe (Sweden: approximately 55 per 100,000; United Kingdom: approximately 35 per 100,000) (40). In some of the developing regions for example Caribbean (approximately 70 per 100,000), South America (approximately 50 per 100,000), Western Africa (approximately 22 per 100,000) and middle Africa (approximately 18 per 100,000) fairly high incidence rates were reported (4). In South-Central Asia (4.1 per 100,000), the estimated age-standardized incidence rate was lowest in the world (4). In 2002, globally the age specific estimated incident rates were 0.2 per 100,000 (15-44

years), 10.6 per 100,000 (45-54 years), 72.9 per 100,000 (55-64 years) and 259.6 (65 years and older) (39). These rates were generally five to nine times greater for men in more developed countries than for men in less developed countries (39).

Figure 2.1 (4) gives a pictorial view of the trends in the incidence rates for countries with high and low risk populations. It is apparent that USA had the highest rates followed by Australia and Canada; and rates were lowest in India.

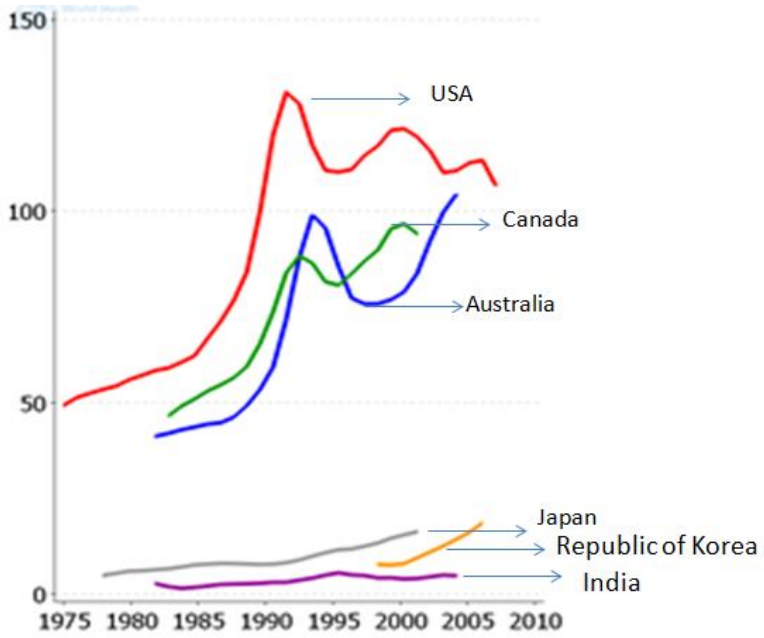

Fig.2.1 Trends in age standardized incidence rates from prostate cancer per 100,000 in selected countries

SOURCE: GLOBOCAN 2008 Cancer Fact Sheet, Accessed 05/10, 2012 (4)

In the year 2008, worldwide, prostate cancer was the sixth most common cause of death (258,000 deaths, 6.1% of the total) (4). The mortality rates did not differ much worldwide and constitutes almost the same number of deaths in both developed and developing nations (4). The mortality rates were highest in Sweden (approximately 25 per 100,000) followed by Zimbabwe, Netherlands and USA (40). In general in the year 2008, mortality rates were high in largely African-American populations (Caribbean 26.3 per 100,000 and sub-Saharan Africa age-standardized rates (ASR) 18-19 per 100,000), very low in Asian populations (e.g. ASR 2.5 per 100,000 in Eastern Asia) and intermediate in Europe and Oceania (4). In 2002, worldwide the

age specific estimated mortality rates were 0.1 per 100,000 (15-44 years), 1.9 per 100,000 (45-54 years), 11.8 per 100,000 (55-64 years) and 100.4 per 100,000 (65 years and older) (39). As cited by Baade et al, worldwide in the year 2002, the age specific mortality rates for men (i) aged 45-54 years in more developed countries were approximately similar to less developed countries (2.0 per 100,00 versus 1.9 per 100,000); (ii) aged 55-64 years in more developed countries were almost twice compared to less developed countries (16.9 per 100,000 versus 9.6 per 100,000); and (iii) aged 65 years and over were almost thrice in more developed countries than less developed countries (169.9 per 100,000 versus 59.5 per 100,000) (39).

Figure 2.2 (4) gives a pictorial view of the trends in the mortality rates for some countries with high and low risk populations. It can be observed that Australia had the highest rates followed by Canada and USA; and mortality rates were lowest in Republic of Korea.

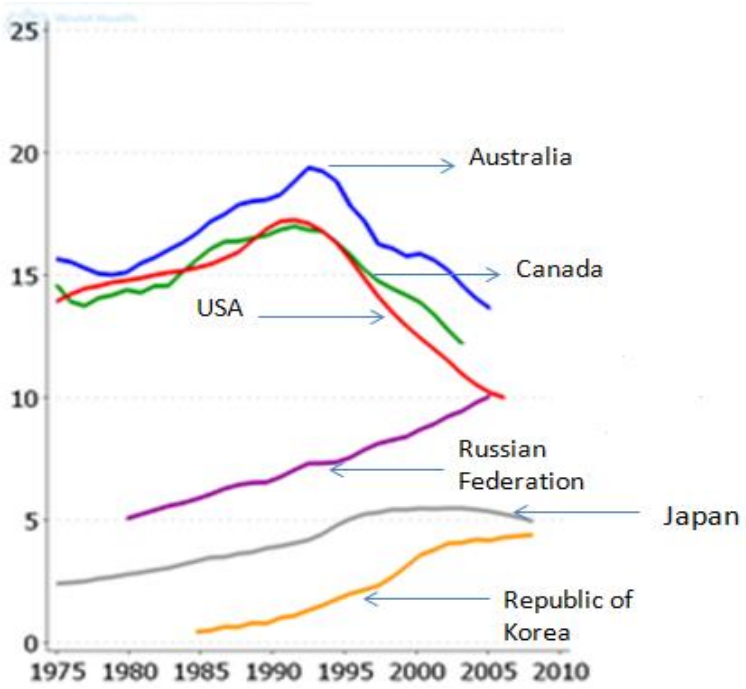

Fig.2.2 Trends in age standardized mortality rates from prostate cancer per 100,000 in selected countries

SOURCE: GLOBOCAN 2008 Cancer Fact Sheet, Accessed 05/10, 2012 (4)

2.2.2 Canada

In 2012, prostate cancer was the most frequently diagnosed cancer in men and was the third most common cause of cancer related deaths after lung and colorectal cancer (2). In Canada, for the year 2012, the estimated number of new cases in men was 26,500 and the estimated number of deaths due to prostate cancer were 4,000 (2). In 2012, the estimated age-standardized rates for incidence and mortality in Canada were 121 per 100,000 and 19 per 100,000 men, respectively (2). In 2000, Quon et al (41) estimated that in future incidence rates will increase from 25,355 new cases in 2009 to 35,121 new cases by 2021. Figure 2.3 and figure 2.4 show the trend in incidence and mortality rates from 1983 to 2012 respectively (8).

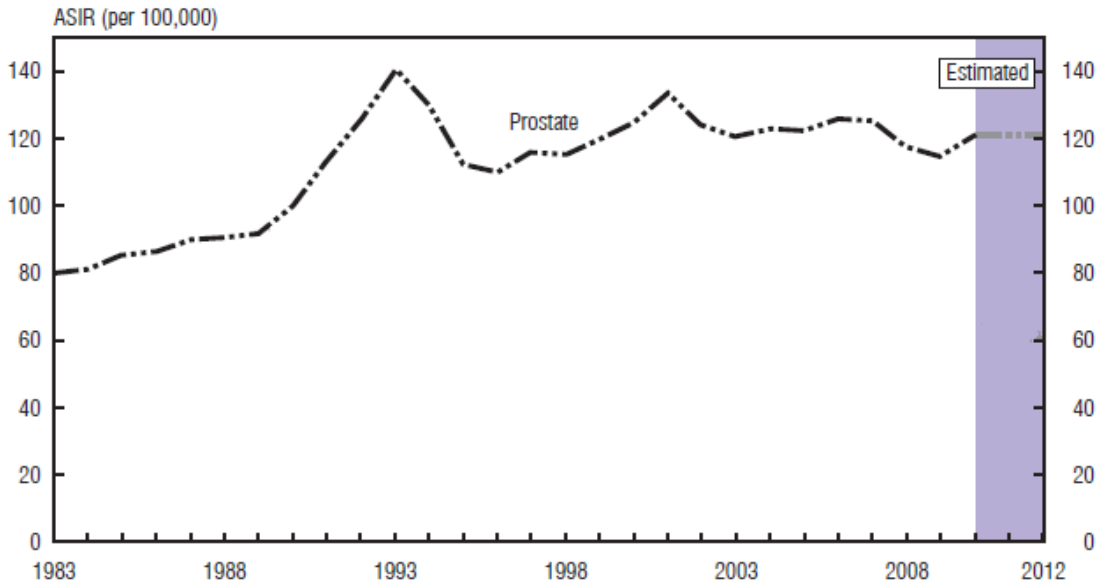

Fig. 2.3 Age-standardized incidence rates for prostate cancer in Canada, 1983 to 2012.
SOURCE: Canadian Cancer Society, Accessed 05/16, 2013 (8)

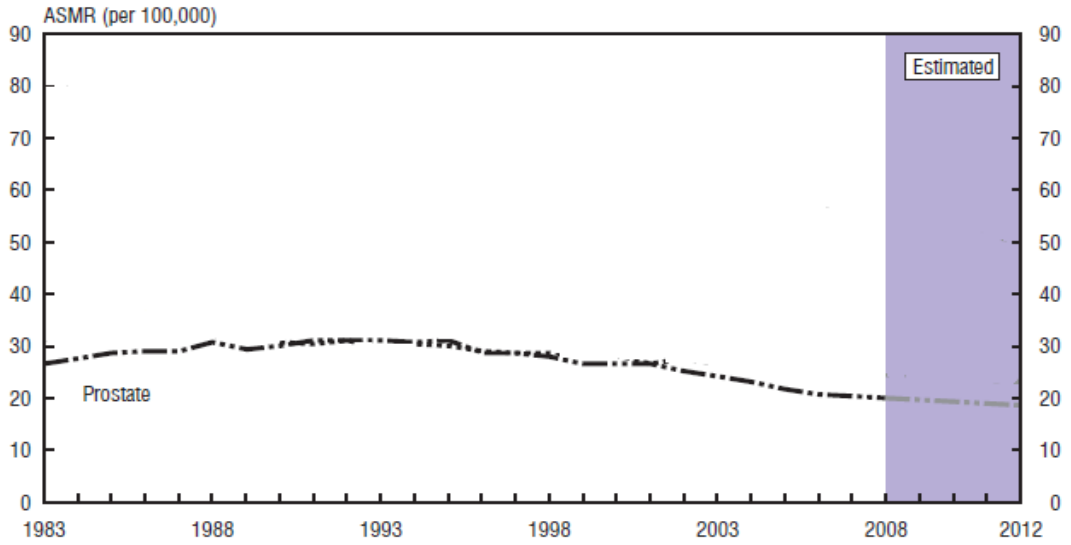

Fig. 2.4 Age-standardized mortality rates for prostate cancer in Canada, 1983 to 2012.

SOURCE: Canadian Cancer Society, Accessed 05/16, 2013 (8)

Figure 2.5 shows the distribution of total estimated number of new cases i.e. 26,500 by age group in 2012. It can be observed that in 2012, maximum number of cases was diagnosed in age group 60-69 years followed by age group 70-79 years (8).

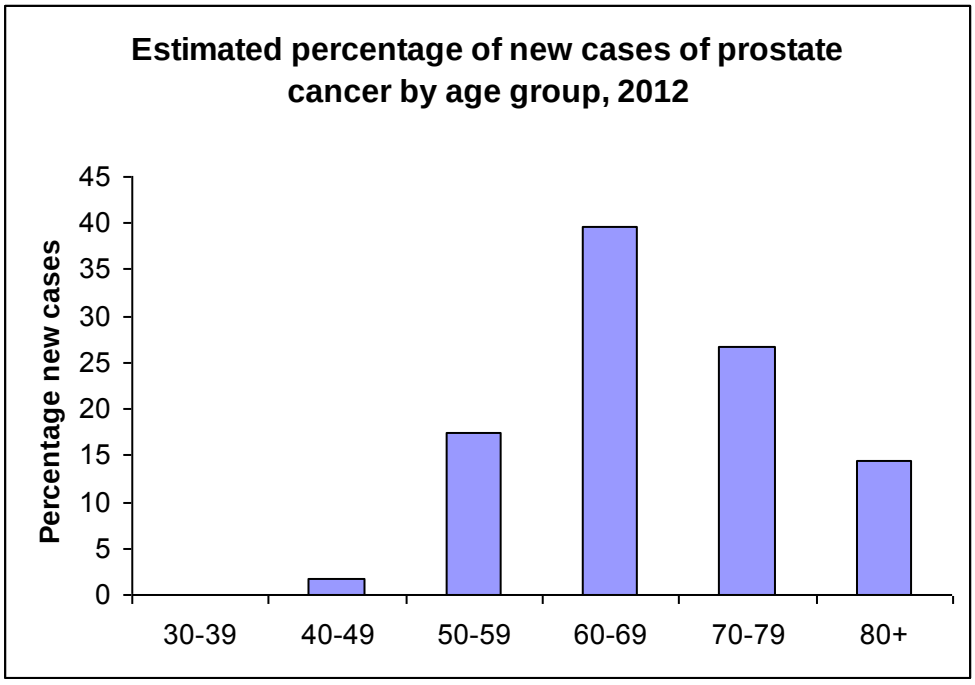

Fig. 2.5 Estimated percent of new cases of prostate cancer by age group, 2012
Created using data from Canadian Cancer Society, Accessed 05/16, 2013 (8)

Figure 2.6 shows the distribution of total estimated number of mortality i.e. 4,000 by age group in 2012. It was found that in 2012, maximum number of deaths were diagnosed in age group 80+ followed by age group 70-79 (8).

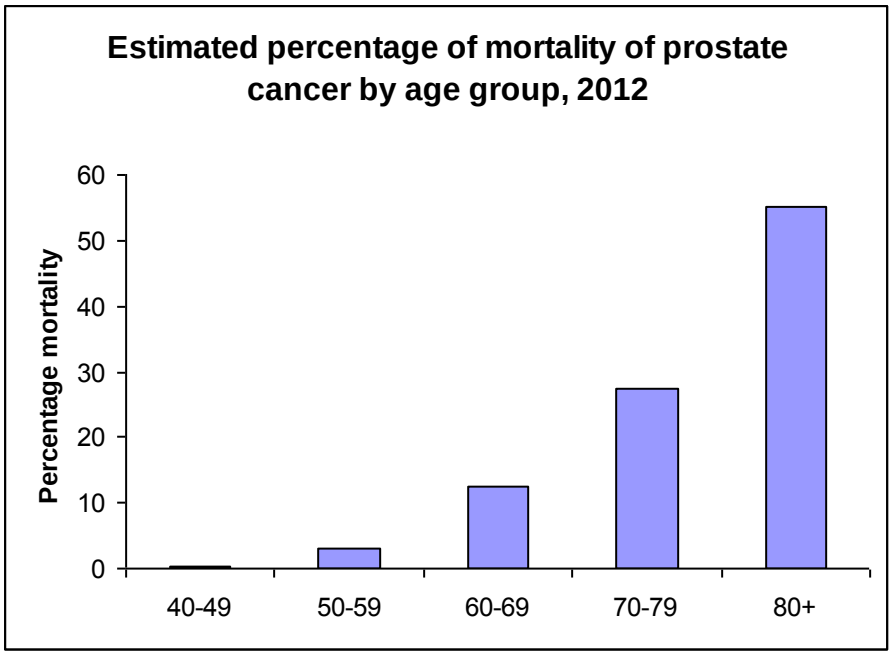

Fig. 2.6 Estimated percent of mortality of prostate cancer by age group, 2012
Created using data from Canadian Cancer Society, Accessed 05/16, 2013 (8)

2.2.3 Saskatchewan

In 2012, prostate cancer was the most frequently diagnosed cancer in Saskatchewan population and was the second most common cause of cancer related deaths after lung cancer (6). According to the Canadian Cancer Society (6), Saskatchewan data suggested that, in the year 2012, an estimated 880 cases were diagnosed with prostate cancer and 210 men were reported to have died of it (6). In 2012, the estimated age-standardized rates for incidence and mortality in Saskatchewan were 136 per 100,000 and 29 per 100,000 men, respectively (8). Figure 2.7 and figure 2.8 show the incidence and mortality rates in the provinces of Canada where Saskatchewan has the third highest incidence rates and the highest mortality rates among other provinces (8).

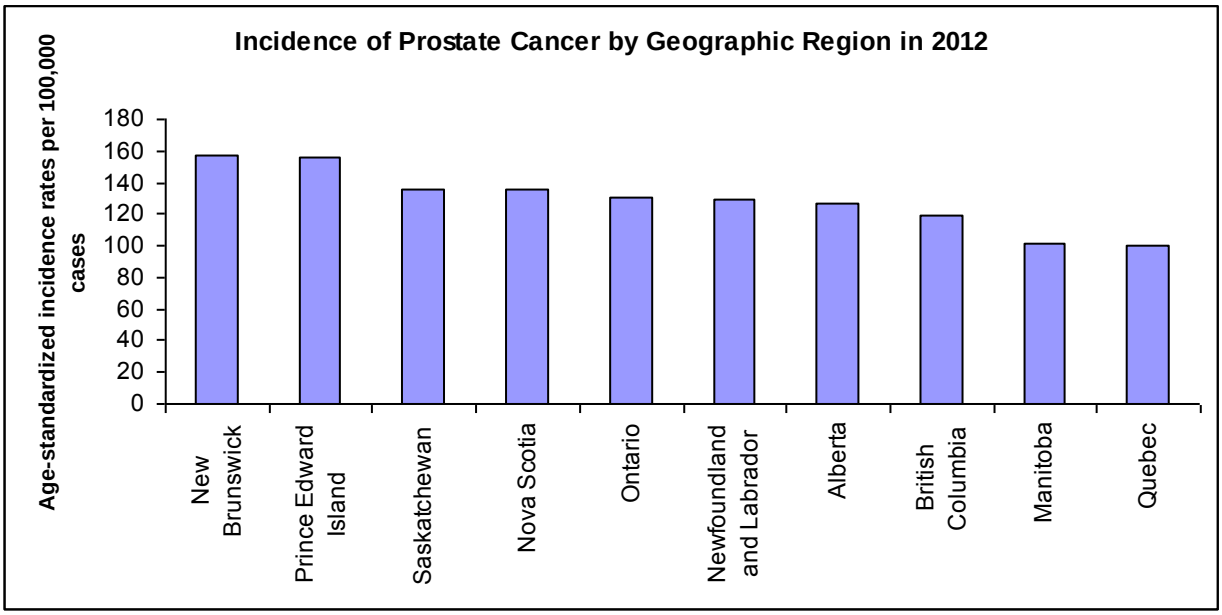

Fig. 2.7 Incidence rates of prostate cancer per 100,000 cases by geographic region, 2012

Created using data from Canadian Cancer Society, Accessed 05/16, 2013 (8)

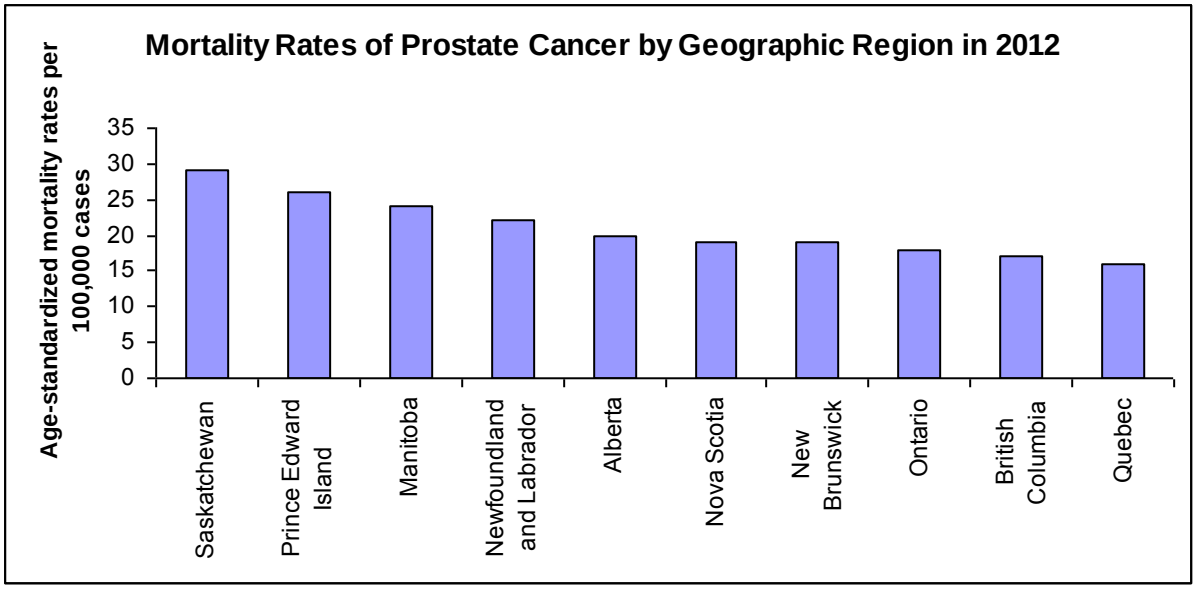

Fig. 2.8 Mortality rates of prostate cancer per 100,000 cases by geographic region, 2012

Created using data from Canadian Cancer Society, Accessed 05/16, 2013 (8)

2.3 Risk Factors and Etiology

Prostate cancer appears to be a multi-factorial disease and its etiology remains unclear in the literature. To date, only three potential risk factors have been well established including age generally over 65 years, race particularly African-Americans, and family history of prostate cancer (9, 10, and 42). According to the Canadian Cancer Society, not every adult male having these risk factors necessarily develops prostate cancer but having these risk factors means it increases the chance of developing it. (42). It can be said that all three established risk factors are non-modifiable risk factors. Given that there are very few well established risk factors of prostate cancer, environmental/farming related exposures requires further investigation (43). The literature calls for more research on the relationship between farming and cancer to identify environmental carcinogens and specific high-risk groups. The literature also suggested that both the environmental and genetic factors may play a role in the development of prostate cancer (9).

2.3.1 Age

Age is known to be a significant risk factor for prostate cancer. As cited by Quinn and Babb, globally three-quarters of cases occurred in men aged ≥ 65 years (40). Very few people aged younger than 50 years are diagnosed with prostate cancer (10, 39 and 44). The mean age of prostate cancer cases is 72-74 years and nearly 85% of cases are diagnosed after 65 years of age (10). The incidence rates of prostate cancer increases with advancing age (9). In countries like USA, Australia, Sweden, United Kingdom, Italy, Japan, Hong Kong and China, incidence rates rose exponentially with advancing age (44). As cited by Fradet et al, in the year 2008 the rate of prostate cancer diagnoses in Canada was approximately 100 per 100,000 in men aged 50 to 54, 500 per 100,000 men aged 60 to 64 and greater than 700 per 100,00 in men over the age of 80 (45). As seen in figure 2.9, in Canada in the year 2004, it is visible that incidence rates began to rise in 45-49 age group and sharply continued to increase until 65-69 age group after which the rates were more or less similar in the following age groups.

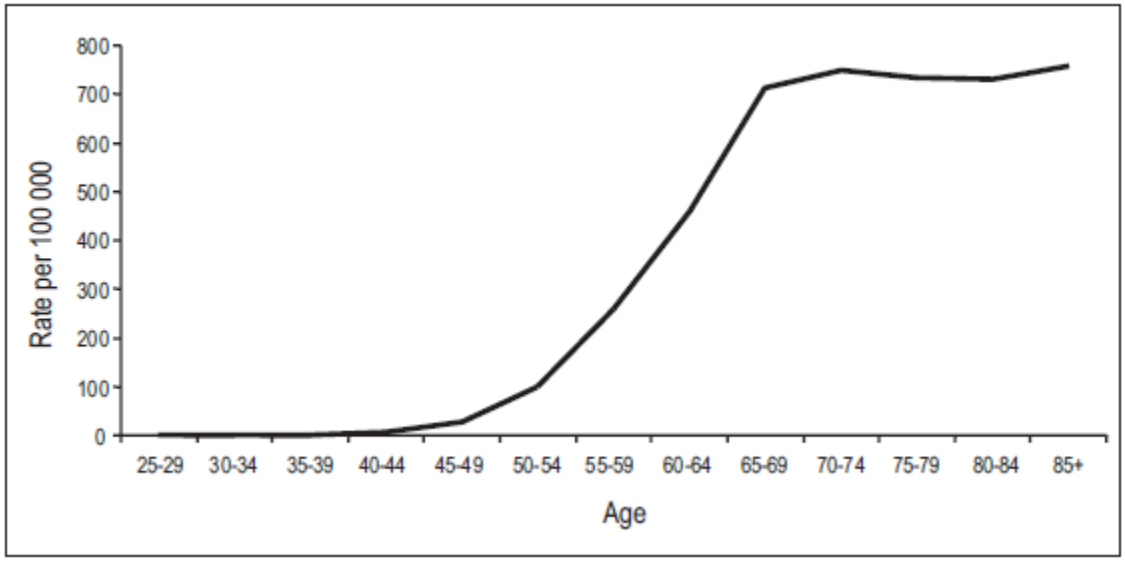

Fig. 2.9 Prostate cancer incidence by age group, Canada, 2004

SOURCE: Canadian Urology Association Journal, Accessed 2012 (45)

Based on evidence from the scientific literature, prostate cancer is very rare among men aged < 50 years. However, an American study with large sample size identified some cases of prostate cancer in these men (46). It consisted of men aged 35-74 years diagnosed with prostate cancer between 1988 and 2003 and identified 1,673 cases (that included grade- low, intermediate and high; Stage I or II, III and IV) of prostate cancer in the youngest age group of 35-44 years. Even though the number was small as compared to the total number (181,099) of men in the age group 65-74 years, it suggested that the investigators must consider this youngest age group seriously in the future studies.

2.3.2 Race

The risk of developing prostate cancer is dramatically higher among African-American men compared to men of any other race (10). This population has the highest incidence rates in the world, nearly 60 times greater than the men in Shanghai, China where rates are lowest (44).

For the period 2005-2009, race-specific incidence rates in the United States ranged from 236.0 per 100, 000 for African-American, 146.9 per 100,000 for Caucasians, 125.9 per 100,000 for Hispanics, 85.4 per 100,000 for Asian/Pacific Islanders, and 78.4 per 100,000 for American/Alaskan natives (47).

African Americans have approximately twice the mortality than that of Caucasians. It is yet uncertain whether these differences in mortality can be explained by differences in stage at diagnosis, socio-economic status or biology of prostate cancer among men from different races. Perhaps genetic and environmental factors or gene-environment interaction could explain these biological explanations (48).

Consumption of dietary fat is also under scrutiny as it is higher among African Americans (49). As cited by Bostwick et al, the rates of prostate cancer shift toward those of the host country. For instance, Japanese men who consume a low fat diet have low incidence rates of prostate cancer in their country. However, the incidence and mortality risk increases when they move to United States (49).

2.3.3 Family History of Prostate Cancer

One of the most consistent and strongest risk factors that have been associated with an increased risk of prostate cancer is family history of prostate cancer. The risk of early onset of prostate cancer is considered to be strongly affected by the number of relatives with prostate cancer and their age at diagnosis (50). Numerous studies have reported familial congregation, showing men who have first-degree male relatives (father, brother, son) with a positive history of prostate cancer have 2 to 3 fold elevated risk (9). Epidemiological studies provide an indication that inherited susceptibility genes cause 5% to 10% of all prostate cancer cases, and 30% to 40% of early onset disease (50). In a population based case-control study of prostate cancer, cases and controls were interviewed as to their family history of prostate cancer. The study provided further evidence of familial congregation and suggested the possibility that part or all of such clustering could be related to inherited genetic patterns (51).

As cited by Fradet et al, according to the United States National Institutes of Health in 2008, men whose fathers had prostate cancer before age 60 years have a 20% chance of developing prostate cancer as compared with 8% of men without this history (45). A slightly greater risk was observed for men whose brothers had prostate cancer than for those whose fathers had prostate cancer. A population based case-control study was conducted among Caucasians, African-Americans and Asian-Americans in United States of America and Canada. The results of this study suggested that in each of the ethnic groups, positive family history was associated with 2 to 3 fold statistically significant increased risk (52). A study consisted of

44,788 twin pairs who were listed in Swedish, Danish and Finnish twin registries found that these inherited factors made a small contribution to susceptibility to prostate cancer. It also indicated that environment played the crucial role in causing sporadic cancer (45).

2.3.4 Cigarette Smoking

Smoking is considered to be a risk factor for several cancers. However, the association between smoking and prostate cancer remains a debatable matter (26-27). As reviewed by Huncharek et al (27), in a meta-analysis of 24 prospective cohort studies, the authors concluded that with more than 26,000 prostate cancer cases, a modest 9% to 30% increase in both incident and mortality specific prostate cancer was associated with smoking. On the contrary, no association was observed between current or former smoking status and prostate cancer incidence (28-29).

Data from large epidemiological studies observed that cigarette smoking is related to prostate cancer mortality (26-27, 29). Moreover, some evidence showed a dose-response relationship between cigarette smoking and prostate cancer mortality (30). Smokers who smoked more than 40 cigarettes per day had 51% increased prostate cancer mortality risk (30). In another prospective cohort study, compared with non-smokers, current smokers had 61% increased risk of dying from prostate cancer (31).

Another study that examined whether cigarette smoking affected the risk of prostate cancer was a prospective US cohort study (26). The study population consisted of men aged 50 to 71 years. Prostate cancer cases were classified into one of the three groups namely non-advanced, advanced and fatal. The results of the study suggested that current smoking and former smoking had decreased risk of non-advanced prostate cancer. In other words, current and former smokers may be at decreased risk of being diagnosed with prostate cancer. However, when compared with non-smokers, current smokers seemed to be associated with an increased risk (Hazard Ratio: 1.69, 95% CI: 1.25-2.27) of fatal prostate cancer.

Another case-control study investigated the relationship between smoking at the time of diagnosis and risk of prostate cancer death (32). A population based cohort of prostate cancer cases aged 40-64 years were included in the study. After adjusting for age, race, education etc, the study found that compared to the cases who never smoked, cases who smoked at the time of diagnosis had a 2.66 relative hazard of prostate cancer-specific mortality.

2.3.5 Farming Occupation and Pesticide Exposure

One of the probable factors that are under scrutiny in literature includes occupation and occupational exposures. In the past, some studies have found associations between occupation and prostate cancer incidence and mortality (17 and 53). Of these, farming has received greater attention (15 and 18). In 1999, the occupational cancer patterns among males in British Columbia who died of prostate cancer between 1950 and 1984 were investigated. This included a review of 216 occupations and 88 industries. One of the findings of this study suggested that farmers were at higher risk of developing prostate cancer (52). However, a review article suggested that it cannot be affirmed with certainty that farmers have an increased risk of developing prostate cancer (15). An elevated risk of prostate cancer among farmers has been investigated in some studies, however no specific associations with agricultural chemicals (pesticides) have been found. The results of one study stated that, as compared to unexposed farmers, farmers who were exposed to pesticides had a two-fold excess risk (19).

Some of the studies that found a positive association between prostate cancer and farming related exposures such as pesticides are discussed in this paragraph. An Italian study evaluated the relationship among rural farmers and found that farmers who were exposed to organochlorine insecticides and acaricides were at a high risk of developing prostate cancer (20). Therefore, it is possible that such pesticides could contribute to the increased risk and should be further investigated in a different population (20). A recent population based case-control study (21) in California investigated the association between environmental pesticide/fungicide exposure and prostate cancer. California is considered the most productive agricultural state in the United States of America and each year the use of agricultural pesticides in California exceeds 250 million pounds of active ingredients. The study provided the evidence that in and around homes in huge agricultural settings, an association between prostate cancer and ambient pesticide exposure to methyl bromide and organochlorines was observed. The researchers also suggested that the associations seem precise to compounds (methyl bromide, capton and organochlorines) with a possible biologic role in prostate carcinogenesis (21). The considerable association between prostate cancer and farming related exposure (such as DDT, simazine and lindane) was observed among farmers in British Columbia (22).

A review conducted by Mink et al suggested that, of eight cohorts and five case-control studies none of them were able to illustrate an increase in risk to support a causal relationship between agricultural pesticide exposure and prostate cancer (23).

In conclusion, based on the scientific literature, farming and its occupational exposures such as insecticides, herbicides and fungicides might be related to prostate cancer. Therefore in this study, this important link was examined in rural Saskatchewan population whose major occupation is farming.

CHAPTER 3: METHODS

3.1 Study Design

The Saskatchewan Rural Health Study is a large prospective cohort study of rural dwelling persons (54). To date, baseline data has been collected using a cross-sectional design. This baseline data was the basis of my thesis. All men older than 45 years in this rural cohort were separated into two groups' namely men who self-reported an earlier diagnosis of prostate cancer and men without prostate cancer. The group of interest were men with prostate cancer only and not with any other type of cancer. The comparison group was the remaining men from the same rural cohort who did not have any type of cancer.

3.2 Study Population, Selection and Recruitment

Rural municipality and small town councils were first approached to describe the study and request permission to use their population records as a sampling frame. This selected population was from rural households in the participating rural municipality and small towns. It included households that were on rural municipality tax lists. Councils of 32 (82%) of 39 rural municipalities and 15 (94%) of 16 small towns agreed to participate in the study. Using the lists provided, the SRHS conducted a baseline mail-out survey in 2010 of 11,982 households located in four geographic regions (Northeast, Northwest, Southeast and Southwest) of Saskatchewan. Dillman's method for mail surveys (53) was used to increase the response rate of the participation. In total, surveys were returned from 4,264 households (42%). This included information on 8,261 adults living in these households. Of these, males greater than 45 years of age (n=2,938) were included as this is the population considered to be at risk. Out of these, 114 had prostate cancer and remaining 2,824 were disease free.

3.3 Data Collection

The SRHS research team, one community member from a rural municipality, and one from small town collectively developed the survey questionnaire. The SRHS team also conducted a pilot study (54) to optimize the administration and content of the baseline questionnaire. These self-administered mailed questionnaires collected information on individual factors (demographic factors, family and occupational history etc), contextual factors (household characteristics etc) and other important covariates (age, marital status etc).

3.4 Theoretical Framework

In order to achieve the objective and to answer the research questions, the Population Health Framework of Health Canada was used. According to this framework, it is suggested that individual and contextual determinants interact to produce varying levels of risk for health outcomes (55). The conceptual framework used to understand the influence of some of the determinants stated above on the health outcome in question is shown in Figure 3.1.

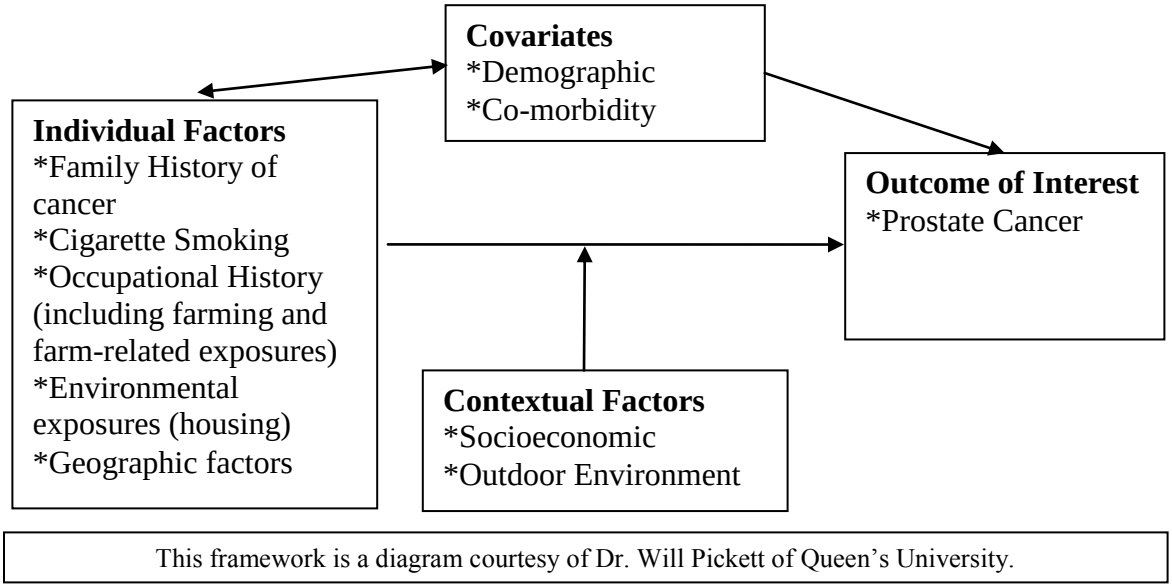

Fig. 3.1 Theoretical Framework for Study

Variables to be examined in this study included outcome (prostate cancer), individual (family history of cancer, cigarette smoking, and occupational history) and contextual factors, and covariates.

Individual factors in the context of this study were a) family history of cancer b) personal cigarette smoking c) occupational history related to farming and d) environmental factors such as housing.

Contextual factors were exclusive to the rural environment and were examined using socioeconomic status and outdoor environment conditions obtained from the baseline questionnaire.

Covariates (potential confounders) included variables such as age, marital status, water source and history of cardiovascular disease such as diabetes, heart disease, stroke etc.

Outcome for prostate cancer was determined from the baseline questionnaire.

3.5 Operational definitions:

The variables that were used for the statistical analysis were determined directly from the survey questionnaire.

- **Family history of cancer** refers to the members of the person's biological family (father, mother and siblings) who ever had any type of cancer based on the question B-56 (See Appendix A).
- **Personal cigarette smoking status** has two categories namely ever smokers and never smokers. This is a derived variable based on the questions B-36 and B-37 (See Appendix A).
- **Smoking pack years** includes four categories namely *no exposure, < 15 years of exposure, ≥ 15 and < 25 years of exposure and ≥ 25 years of exposure.* It is defined as the total number of years a person has smoked multiplied by the average cigarettes smoked per day**.** This study considers 20 cigarettes per pack for the analysis. Pack years is a derived variable based on question B-38, B-40 to B-42 (See Appendix A).
- **Occupational history** refers to the list of all full-time jobs at which a person has worked for at least one year that includes *job title, business/industry/service and total number of years at job*. Many participants had more than one job over their lifetime. Study participants whose one of the listed occupations on survey was either farmers or farm managers; or farm supervisors and specialized livestock workers; or general farm workers were categorized as ever having a farming job. Those who did not have any of these listed occupations were considered as having no farming occupation. Each job title was categorized into one of the industry and occupation unique to the primary industry using the North American Industry Classification System (NAICS) - Canada (60) and the National Occupational Classification for Statistics (NOC-S) 2006 (61). This variable was based on the question B-57 (See Appendix A).
- **Occupational rural exposures** include exposure to grain dust, wood dust, livestock, herbicides, fungicides and insecticides etc. If the exposure is considered present,

participants are asked "How often (daily, weekly, monthly and occasionally) they are exposed to these exposures and for how many years?" This variable is based on question B-58 (See Appendix A).

- **Duration of farming** includes four categories namely *no exposure*, *< 30 years of exposure, ≥ 30 and < 50 years of exposure and ≥ 50 years of exposure*. It was a derived variable and was calculated to obtain the total number of years in the farming occupation. For example, if a person had more than one farming occupation during his life, a total of farming years corresponding to the farming occupations was calculated. Then the calculated total farming years of each participant was compared with their corresponding age. According to the labor standards, age 16 was established as the general minimum age of employment in Saskatchewan (62). However, it was observed that for 316 men, the difference between age and total farming years was < 16 meaning they would have started employment under 16 years. Therefore to resolve this problem, data corresponding to the age and total farming years was cleaned to get the appropriate number of farming years for a participant. To do this, two new variables namely difference (calculated difference between a participant's age and his total farming years) and new total farming years were created. If the value of the variable difference was < 0 years, then the new total farming years = age-16 years; if the difference was ≥ 0 or < 16 years then the new total farming years = total farming years – (16-difference); and if the difference was > 16 years then there was no change in the total number of farming years i.e. = total farming years. This variable was based on question B-57 (See Appendix A).
- **History of cardiovascular diseases** includes heart disease, heart attack, hardening of the arteries and high blood pressure. It is based on questions B50 (See Appendix A).
- **Geographic factors** include variables such as *residence* and *quadrant*. Residence has three categories namely farm, in town and acreage and quadrant has four categories (North-West, North-East, South-West, and South-East). The information on quadrant was based on 2006 census subdivisions showing quadrant. Farm refers to farm residential and work locations that are involved in the production of agricultural products intended for sale. For the analyses, the two categories i.e. in town and acreage are combined into one category i.e. non-farm based on question A-1 (See Appendix A).

- **Household smell** has two categories namely *yes* and *no* based on question A-14 (See Appendix A).
- **Household pesticide application** includes two categories namely *yes* and *no* based on question A-16 (See Appendix A).
- **Household tobacco smoke** included three variables namely exposure to cigarettes, cigars and pipes having two categories each i.e. *yes* and *no* based on question A-17 (See Appendix A).
- **Highest level of education** has 4 categories namely, *less than high school, completed high school, completed university and completed post-secondary education other than above.* This is dichotomized into a variable EDUGRP having two categories namely, ≤ *Grade 12 and >Grade 12* based on question B-4 (See Appendix A).
- **Household income adequacy** is categorized in four groups based on household income levels and number of people in home according to STAT CANADA_NPHS (National Population Health Survey) definition (58). It is further categorized into *low income, middle income, and high income* based on question A-2 and A-20 (See Appendix A).
- **Marital status** has two categories namely *married/common law/living together and widowed/divorced/separated/single, never married* based on question B-8 (See Appendix A).
- **Age** is a continuous variable. It is dichotomized into a new variable having categories namely ≤ *65 years and > 65 years* based on question B-1 (See Appendix A).
- **Water source** has 4 categories namely *bottled water, deep well water (more than 100 ft), shallow well water (less than 100 ft) and other source* based on question A-37 (See Appendix A).
- **Prostate cancer** as an outcome variable "Has a doctor or primary care giver ever said you have cancer? If yes, specify type of cancer" is determined from survey questionnaire. It is defined as "self-report of an earlier diagnosis of prostate cancer" based on question B-50 (See Appendix A).

3.6 Sample Size

We obtained a sample size of 2,938 men who were older than 45 years. Of these, there were 114 men with prostate cancer and 2,824 men without prostate cancer. In order to evaluate the post-hoc power of the study, following formula (56) for an unequal case control ratio was used.

$\widehat{Z_\beta} = [n (p_1 - p_0)^2 / (1 + 1/c) \overline{p'} \overline{q'}]^{1/2} - Z\alpha$ …… (3.1)

Where,

n = number of cases

c = number of controls per case i.e. 2800/113 = 25

p_0 = the relative frequency of exposure among controls in the target population i.e. 1277/2800 = 0.46

R = a hypothesized relative risk associated with exposure that would have sufficient biologic or public health importance to warrant its detection. Say R= 1.5 and R=2

α = the desired level of significance i.e. α= 0.05. Therefore $Z_\alpha = 1.96$

Power = P($Z \leq Z_\beta$) , Power is determined using standard normal distribution tables.

Table 3.1: Residence i.e. farm and non-farm among men with prostate cancer and men without prostate cancer

	Prostate cancer Present	**Prostate cancer Absent**	**Total**
Farm	52	1277	1329
Non-Farm	61	1523	1584
Total	113	2800	2913

Calculating power using values from above table:

<u>Power calculation at R= 1.5</u>

C= 25, p_0 = 0.46

$p_1 = p_0R / [1 + p_0 (R-1)] = 0.56$

$\overline{p'} = (p_1 + cp_0) / (1+c) = 0.46$

$\overline{q'} = 1 - \overline{p'} = 0.54$

After substituting all the above values in formula (i), we get

$Z_\beta = 0.12$

Power = $P (Z \leq Z_\beta) = 55\%$

The study will have an estimated 55% chance of detecting 1.5 times increase in the risk of prostate cancer.

Power calculation at R= 2

C= 25, $p_0 = 0.46$

$p_1 = p_0R / [1 + p_0 (R-1)] = 0.63$

$\overline{p'} = (p_1 + cp_0) / (1+c) = 0.47$

$\overline{q'} = 1 - \overline{p'} = 0.53$

After substituting all the above values in formula (i), we get

$Z_\beta = 1.60$

Power = $P (Z \leq Z_\beta) = 95\%$

The study will have an estimated 95% chance of detecting 2 times increase in the risk of prostate cancer.

Power calculation at R= 1.72

C= 25, $p_0 = 0.46$

$p_1 = p_0R / [1 + p_0 (R-1)] = 0.594$

$\overline{p'} = (p_1 + cp_0) / (1+c) = 0.465$

$\overline{q'} = 1 - \overline{p'} = 0.535$

After substituting all the above values in formula (i), we get

$Z_\beta = 0.84$

Power = $P (Z \leq Z_\beta) = 80\%$

The study will have an estimated 80% chance of detecting 1.72 times increase in the risk of prostate cancer.

Table 3.2: Post-hoc Power Analysis based on prostate cancer present (n= 113) and prostate cancer absent (n = 2824) for different values of the relative frequency of exposure among controls in the target population (p_0) and relative risk (R)

R / P_0	1.5	2	2.5
0.40	57%	95%	100%
0.45	55%	94%	100%
0.50	55%	94%	100%
0.55	46%	91%	100%

The above table shows that the study has enough sample size to detect relative risk of 2 and higher for relative frequency of exposure to residence (farm/non-farm) between 40% to 55%.

3.7 Statistical Analysis

Analysis for Research Question 1:

In order to investigate research question 1, firstly crude prevalence of prostate cancer was determined using the formula; Prevalence= number of existing cases of a disease at a given point in time/ total population at a given point in time. Among cases, 46% of men lived on farm. It was followed by determining age adjusted prevalence using 2011 census data.

Analysis for Research Question 2a:

In order to analyze the data, chi-square tests were applied to determine the univariate association between prostate cancer and rural exposures (occupational i.e. farming and environmental), household musty smell and pesticide application. The association was assessed using multiple logistic regression models. Variables with $p<0.25$ were the candidate variables for a full multivariable model. All main effects variables which were statistically significant $p<0.05$ in the full model were retained in the final multivariable model. In addition to this, variables of biological importance and potential confounders were included in the models. Significant interactions at $p <0.1$ based on scientific/clinical importance were retained in the final model. The Hosmer-Lemeshow statistic was conducted to assess the goodness of fit for a model. The strength of associations was presented by odds ratios and their 95% confidence intervals.

Analysis for Research Question 2b:

To analyze research question 2b, firstly chi-square tests were used to determine the univariate association between personal smoking history, household smoke and prostate cancer. Then the association was assessed using multiple logistic regression models. Variables with $p<0.25$ were the candidate variables for a full multivariable model obtained from research question 2a. All main effects variables which were statistically significant $p<0.05$ in the full model were retained in the final multivariable model. In addition to this, variables of biological importance and potential confounders were included in the models. Significant interactions at $p<0.1$ based on scientific/clinical importance were retained in the final model. The Hosmer-Lemeshow statistic was conducted to assess the goodness of fit for a model. The strength of associations was presented by odds ratios and their 95% confidence intervals.

Analysis for Research Question 2c:

To investigate this research question, firstly chi-square tests were used to determine the univariate association between age, family history of cancer and prostate cancer. Then the association was assessed using multiple logistic regression models. Variables with $p<0.25$ became the candidate variables for a full multivariable model obtained from research question 2b. All main effects variables which were statistically significant $p<0.05$ in the full model were retained in the final multivariable model. In addition to this, variables of biological importance and potential confounders were included in the models. Significant interactions at $p<0.1$ based on scientific/clinical importance were retained in the final model. The Hosmer-Lemeshow statistic was conducted to assess the goodness of fit for a model. The strength of associations was presented by odds ratios and their 95% confidence intervals.

Analysis for Research Question 3:

In order to investigate the above research question, final models obtained from research question 2a, 2b and 2c were used and assessed interaction (family history and; occupational rural exposure such as exposure to grain dust, pesticides etc and environmental rural exposure such as household pesticide application) in this model. Interactions which were statistically significant at $p<0.1$ in the full model were retained in the final multivariable model. The association accounting for statistically significant interactions was presented using stratified analysis. The

Hosmer-Lemeshow statistic was conducted to assess the goodness of fit for a model. The strength of associations was presented by odds ratios and their 95% confidence intervals. The final model included main effects and significant interactions such as rural exposure to pesticides and family history of cancer.

CHAPTER 4: RESULTS

4.1 Participation and Descriptive Characteristics

The presence (cases) or absence (non-cases) of prostate cancer was determined from the study questionnaire. In total, surveys were returned from 4,264 households (42%). This included information on 8,261 adults living in these households. Of these, males greater than 45 years of age (n=2,938) were included as part of this thesis analysis and this is the population considered to be at risk. Out of these, 114 were prostate cancer cases and remaining 2,824 were non-cases.

Approximately 30.6% of farm residents were older than 65 years as compared to 40.0% of non-farm residents (Table 4.1). With regards to family history of cancer (i) a similar proportion of farm (30.4%) and non-farm residents (30.5%) reported having no family history of cancer (ii) 29.1% of farm residents reported having one cancer in their family as compared to 24.3% of non-farm residents (iii) 11.9% of farm residents reported having two cancers in their family as compared to 11.7% of non-farm residents and (iv) 3.2% of farm residents reported having three or more cancers in their family as compared to 5.1% of non-farm residents. It was observed that 47.4% of farm residents had ever smoked in their lifetime as compared to 63.2% of non-farm residents. Approximately 93.5% of farm residents ever had a farming occupation as compared to 48.1% of non-farm residents. Farm residents who ever been exposed to a combination of insecticides and fungicides at their work-place were nearly 57.7% as compared to non-farm residents i.e. 35.7% (Table 4.1).

Table 4.1 Descriptive characteristics of study participants stratified by farm and non-farm residence status

Variables	Farm N=1329	Non-Farm N=1584	p-value	Overall N=2938
Age				
≤ 65 Years	922 (69.4)	950 (60.0)		1872 (64.3)
> 65 Years	407 (30.6)	634 (40.0)	<0.001	1041 (35.7)
Education				
> Grade 12	308 (23.5)	477 (30.5)		785 (27.3)
≤ Grade 12	1001 (76.5)	1089 (69.5)	<0.001	2105 (72.7)
Marital Status				
Married, common law or living together	1181 (89.1)	1358 (86.1)		2539 (87.5)
Widowed, divorced, separated or single/never married	145 (10.9)	219 (13.9)	0.02	364 (12.5)
Household Smell				
No	1020 (79.9)	1356 (87.9)		2376 (84.3)
Yes	257 (20.1)	187 (12.1)	<0.001	444 (15.7)
Household Pesticide Application				
No	990 (75.2)	1284 (81.9)		2274 (78.8)
Yes	327 (24.8)	284 (18.1)	<0.001	611 (21.2)
Household Income Adequacy				
High Income	539 (50.0)	558 (41.2)		1097 (45.1)
Middle Income	345 (32.0)	485 (35.8)		830 (34.1)
Low Income	195 (18.1)	310 (22.9)	<0.001	505 (20.8)
History of Cardiovascular Disease				
No	773 (58.6)	806 (51.4)		1579 (54.7)
Yes	545 (41.4)	763 (48.6)	<0.001	1308 (45.3)

Family History of Cancer				
No Cancer	404 (30.4)	483 (30.5)		887 (30.4)
One Cancer	387 (29.1)	385 (24.3)		772 (26.5)
Two Cancers	158 (11.9)	185 (11.7)		343 (11.8)
Three or More Cancers	43 (3.2)	80 (5.1)		123 (4.2)
Do Not Know/Missing	337 (25.4)	451 (28.5)	0.01	788 (27.1)
History of Personal Smoking				
Never Smoker	696 (52.6)	580 (36.8)		1276 (44.0)
Ever Smoker	627 (47.4)	997 (63.2)	<0.001	1624 (56.0)
History of Smoking Pack Years				
No Exposure	700 (55.2)	583 (39.0)		1283 (46.5)
< 15 Years	271 (21.4)	340 (22.8)		611 (22.1)
≥ 15 and < 25 Years	124 (9.8)	199 (13.3)		321 (11.7)
≥ 25 Years	173 (13.6)	372 (24.9)	<0.001	545 (19.7)
Quadrant				
North West	384 (28.9)	478 (30.2)		862 (29.6)
South West	222 (16.7)	332 (21.0)		554 (19.0)
South East	256 (19.3)	344 (21.7)		600 (20.6)
North East	467 (35.1)	428 (27.1)	<0.001	895 (30.7)
Farming Job				
Never Farming Job	85 (6.5)	778 (51.9)		863 (30.8)
Ever Farming Job	1219 (93.5)	720 (48.1)	<0.001	1939 (69.2)
Farming Duration				
No Exposure	91 (7.2)	789 (53.6)		880 (32.1)
< 30 Years	195 (15.3)	262 (17.8)		457 (16.7)
≥30 and < 50 Years	770 (60.5)	265 (18.0)		1035 (37.7)
≥ 50 Years	216 (17.0)	156 (10.6)	<0.001	372 (13.6)

At work, ever been exposed to Insecticides and Fungicides				
Insect No Fung No	284 (21.4)	696 (44.4)		980 (33.9)
Insect Yes Fung No	174 (13.1)	248 (15.8)		422 (14.6)
Insect No Fung Yes	104 (7.8)	64 (4.1)		168 (5.8)
Insect Yes Fung Yes	766 (57.7)	559 (35.7)	<0.001	1325 (45.8)
At work, ever been exposed to Radiation				
No	1221 (91.9)	1427 (91.1)		2648 (91.5)
Yes	107 (8.1)	140 (8.9)	0.40	247 (8.5)
Water Source				
Bottled Water	377 (28.5)	454 (29.3)		831 (29.0)
Deep Well Water	288 (21.8)	409 (26.4)		697 (24.3)
Shallow Well Water	469 (35.5)	162 (10.5)		631 (22.0)
Other Source	188 (14.2)	522 (33.7)	<0.001	710 (24.7)

Due to missing observations for some variables, the column total by categories may not equal the column totals

4.1.1 Personal and Household Characteristics of Study Participants

For the sake of ease from now onwards we will define cases as those participants who self-reported an earlier diagnosed prostate cancer and everyone else as non-cases. Most of the cases with prostate cancer were older than 65 years of age (77.2%) as compared to non-cases (34.2%). The mean age of cases and non-cases was 74.4 years (standard deviation: 10.6) and 61.9 years (standard deviation 10.8) respectively. The proportion of cases having educational attainment > Grade 12 (15.0%) was less than the non- cases (27.8%). As compared to 12.3% non-cases, 20.2% of cases were either divorced or separated. It was observed that majority of non-cases (46.0%) had a high household income whereas majority of cases' household income was either low (37.5%) or middle (38.6%) (Table 4.2).

Table 4.2 Descriptive and Univariate Analysis of Personal and Household Characteristics of Study Participants by Presence or Absence of Prostate Cancer

Variables	Prostate Cancer Present (N=114)	Prostate Cancer Absent (N=2824)	Unadjusted OR (95% CI)	p-value
Age				
≤ 65 Years	26 (22.8)	1858 (65.8)	1.00	
> 65 Years	88 (77.2)	966 (34.2)	6.51 (4.17, 10.15)	**<0.001**
Education				
> Grade 12	17 (15.0)	775 (27.8)	1.00	
≤ Grade 12	96 (85.0)	2009 (72.2)	2.18 (1.29, 3.67)	**<0.001**
Marital Status				
Married, common law or living together	91(79.8)	2467 (87.7)	1.00	
Widowed, divorced, separated or single/never married	23 (20.2)	346 (12.3)	1.80 (1.12, 2.89)	**0.01**
Household Smell				
No	87 (79.1)	2309 (84.5)	1.00	
Yes	23 (20.9)	423 (15.5)	1.44 (0.90, 2.31)	**0.13**
Household Pesticide Application				
No	87 (78.4)	2203 (78.8)	1.00	
Yes	24 (21.6)	592 (21.2)	1.03 (0.65, 1.63)	0.91
Household Income Adequacy				
High Income	21 (23.9)	1083 (46.0)	1.00	
Middle Income	34 (38.6)	799 (33.9)	2.19 (1.26, 3.81)	**<0.001**
Low Income	33 (37.5)	474 (20.1)	3.59 (2.06, 6.27)	**<0.001**
History of Cardiovascular Disease				
No	44 (39.3)	1547 (55.2)	1.00	
Yes	68 (60.7)	1253 (44.8)	1.91 (1.30, 2.81)	**<0.001**

Family History of Cancer				
No Cancer	27 (23.7)	868 (30.7)	1.00	
One Cancer	33 (28.9)	745 (26.4)	1.42 (0.85, 2.39)	**0.18**
Two Cancers	15 (13.2)	334 (11.8)	1.44 (0.76, 2.75)	0.26
Three or More Cancers	12 (10.5)	112 (4.0)	3.44 (1.70, 6.70)	**<0.001**
Do Not Know/Missing	27 (23.7)	765 (27.1)	1.13 (0.66, 1.95)	0.65
Personal Smoking History				
Never Smoker	44 (38.6)	1241 (44.1)	1.00	
Ever Smoker	70 (61.4)	1570 (55.9)	1.26 (0.86, 1.85)	**0.24**
History of Smoking Pack Years				
No Exposure	45 (42.9)	1247 (46.5)	1.00	
< 15 Years	26 (24.8)	590 (22.0)	1.22 (0.75, 2.00)	0.52
≥ 15 and < 25 Years	18 (17.1)	306 (11.4)	1.63 (0.93, 2.86)	0.43
≥ 25 Years	16 (15.2)	536 (20.0)	0.83 (0.46, 1.48)	**0.09**

Due to missing observations for some variables, the column total by categories may not equal the column totals

Almost 60.7% of cases also reported having a history of cardiovascular disease including heart disease, heart attack, hardening of the arteries and high blood pressure as compared to 44.8% of non-cases. With regards to family history of cancer (i) 23.7% of cases had no family history of cancer as compared to 30.7% of non-cases (ii) 28.9% reported having one cancer in their family as compared to 26.4% of non-cases (iii) 13.2% of cases reported having two cancers in their family as compared to 11.8% of non-cases and (iv) 10.5% of cases reported having three or more cancers in their family as compared to 4.0% of non-cases (Table 4.2).

Personal smoking history was categorized into ever smokers (included ex-smokers and current smokers) and never smokers. Most of the cases (61.4%) had ever smoked in their lifetime compared to non-cases i.e. 55.9%. History of smoking pack years was also calculated for those who were ever smokers i.e. (i) 24.8% of cases had < 15 smoking pack years vs. 22.0% of non-cases (ii) 17.1% of cases as compared to 11.4% of non-cases had ≥ 15 and < 25 smoking pack years (iii) 15.2% of cases and 20.2 of non-cases had ≥ 25 smoking pack years (Table 4.2).

4.1.2 Occupational and Environmental Characteristics of Study Participants

A higher proportion of men with prostate cancer (82.5%) ever had worked a farming job in their lifetime. However, this proportion was significantly less among non-cases (68.8%) (Table 4.3). The total number of years in the farming occupation was categorized into four categories: no exposure (who never had farming as an occupation); < 30 years of farming; ≥ 30 and < 50 years of farming; and ≥ 50 years of farming. Among cases 18.4% had no exposure to farming compared to 32.5% among non-cases; 17.3% of cases compared to 16.5% of non-cases had farming years < 30; 29.6% of cases compared to 38.1% of non-cases had farming years ≥ 30 and < 50 and 34.7% of cases as compared to 12.8% of non-cases had a total of ≥ 50 years of farming (Table 4.3).

Table 4.3 Descriptive and Univariate Analysis of Environmental and Farming Occupational Characteristics of Study Participants by Presence or Absence of Prostate Cancer

Variables	Prostate Cancer Present (N=114)	Prostate Cancer Absent (N=2824)	Unadjusted OR (95% CI)	p-value
Residence				
Non-Farm	61 (54.0)	1523 (54.4)	1.00	
Farm	52 (46.0)	1277 (45.6)	1.02 (0.70, 1.48)	0.93
Quadrant				
North West	24 (21.1)	846 (30.0)	1.00	
South West	23 (20.2)	534 (18.9)	1.52 (0.85, 2.72)	**0.16**
South East	25 (21.9)	583 (20.7)	1.51 (0.85, 2.67)	**0.15**
North East	42 (36.8)	859 (30.4)	1.72 (1.03, 2.87)	**0.04**
Farming Job				
Never Farming Job	18 (17.5)	850 (31.2)	1.00	
Ever Farming Job	85 (82.5)	1870 (68.8)	2.15 (1.28, 3.59)	**<0.001**
Farming Duration				
No Exposure	18 (18.4)	867 (32.5)	1.00	
< 30 Years	17 (17.3)	441 (16.5)	1.86 (0.95, 3.64)	**0.07**
≥30 and < 50 Years	29 (29.6)	1016 (38.1)	1.37 (0.76, 2.49)	0.29
≥ 50 Years	34 (34.7)	341 (12.8)	4.80 (2.68, 8.62)	**<0.001**
At work, ever been exposed to Insecticides and Fungicides				
Insect No Fung No	23 (20.4)	969 (34.5)	1.00	
Insect Yes Fung No	16 (14.2)	408 (14.5)	1.65 (0.86, 3.16)	**0.12**
Insect No Fung Yes	5 (4.4)	165 (5.9)	1.28 (0.48, 3.40)	0.63
Insect Yes Fung Yes	69 (61.1)	1265 (45.1)	2.30 (1.42, 3.71)	**<0.001**

At work, ever been exposed to				
Radiation				
No	91 (80.5)	2580 (91.9)	1.00	
Yes	22 (19.5)	227 (8.1)	2.75 (1.69, 4.46)	<**0.001**
Water Source				
Bottled Water	28 (25.7)	809 (29.1)	1.00	
Deep Well Water	28 (25.7)	675 (24.3)	1.20 (0.70, 2.04)	0.51
Shallow Well Water	14 (12.8)	626 (22.5)	0.65 (0.34, 1.24)	**0.19**
Other Source	39 (35.8)	673 (24.2)	1.67 (1.02, 2.75)	**0.04**

Since there were missing observations for some variables, the column total may not total 114 (prostate cancer present) and 2824 (prostate cancer absent).

Information on work place exposures such as grain dust, livestock, welding fumes, insecticides, herbicides, fungicides and radiation was also gathered. Almost 89.4% of cases compared to 84.7% of non-cases were exposed to grain dust at work, 74.3% of cases as compared to 63.8% of non-cases were exposed to livestock, 77.0% of cases compared to 69.1% of non-cases were exposed to welding fumes at work, 84.1% of cases than 70.1% of non-cases were exposed to herbicides, 65.5% of cases as compared to 50.9% of non-cases were exposed to fungicides, 75.2 % of cases as compared to 59.6% of non-cases were exposed to insecticides and 19.5% of cases as compared to 8.1% of non-cases were exposed to work place radiation.

It was observed that a similar proportion (46%) of cases and non-cases were residing on a farm than non-farm. Quadrant wise (i) 21.1% of cases as compared to 30.0% of non-cases were dwelling in the North West, (ii) 20.2% of cases as compared to 18.9% of non-cases were dwelling in the South west, (iii) 21.9% of cases as compared to 20.7% of non-cases were dwelling in the South East and (iv) 36.8% of prostate cancer cases as compared to 30.4% of non-cases were dwelling in the North East quadrant of southern Saskatchewan (Table 4.3).

The main source of water supply for drinking purposes at home was also assessed with regards to prostate cancer. A similar proportion of cases (25.7%) had bottled water and deep well water as their source of drinking water as compared to 29.1% and 24.3% of non-cases. Nearly 12.8% of cases vs. 22.5% of non-cases had shallow well as the source of drinking water and remaining 35.8% of cases and 24.2% of non-cases had other source of drinking water supply (Table 4.3).

4.1.3 Univariate Associations

Increasing age was observed to be the strongest risk factor of prostate cancer. Men who were > 65 years of age were 6.51 times more at risk of prostate cancer as compared to men ≤ 65 years. Cases who reported to have been divorced or separated (OR= 1.80), reported having education level ≤ grade 12 (OR= 2.18) were at an increased risk of prostate cancer. Cases with low income and middle income households were 3.59 times and 2.19 times were observed to be at higher risk of prostate cancer respectively as compared to high income households. Cases having three or more cancers in their family were atleast 3.44 times at risk of prostate cancer as compared to cases having no cancer in their family. Exposure to household musty smell increased the risk of prostate cancer by 1.44 times. Men who had a history of cardiovascular disease were 1.91 times more at risk of as compared to men with no such history (Table 4.2).

It was also observed that men who ever smoked were 1.26 times more at risk of prostate cancer as compared to men who never smoked in their lifetime. At univariate level, the risk was observed to increase by 1.22 times and 1.63 times among men who smoked < 15 pack years and ≥ 15 and < 25 pack years respectively as compared to men with no exposure to pack years. The risk however was observed to be reduced by 0.83 times among men who smoked ≥ 25 pack years as compared to men with no such exposure (Table 4.2).

Farm residence was observed to have no statistically significant relationship with the prostate cancer at the univariate level. However, this variable was included in all the multivariate analyses as it was of prime interest. Quadrant increased the risk of prostate cancer, for example residents of South-West and South-East were 1.50 times and resident of North-East were 1.70 times at risk compared to North-West residents (Table 4.3).

The trend was for farmers based on occupation to have an increased risk (OR=2.15) of prostate cancer than non-farmers. Also, the duration of farming job escalated the risk by 1.86 times and 4.80 times among men who had < 30 years and ≥ 50 years of farming duration respectively. Considering the work-place exposure, men who were exposed to insecticides and fungicides together were 2.30 times at risk of prostate cancer than who did not have this exposure. Work-place exposure to radiation was also observed to be associated with the outcome of interest thus increasing the risk by 2.75 times. Men who had shallow well water as their source of drinking water were observed to have a reduced risk by 0.65 times than bottled water (Table 4.3).

4.2 Research Question1: Prevalence

"What is the prevalence of prostate cancer in rural farm and non-farm dwelling men older than 45 years of Saskatchewan in 2010-2011?"

Crude and age standardized prevalence of prostate cancer was calculated. The overall crude prevalence was 3.88%. The overall age- standardized prostate cancer prevalence was 3.32% and using the two proportions test, it was observed that differences in the age standardized prevalence of prostate cancer were not statistically significant between farm and non-farm residence (Table 4.4).

Table 4.4 Crude and Age Standardized Prostate Cancer Prevalence (men > 45 years) by Farm/Non-farm Residence Status

	Prostate Cancer Present	Crude Prevalence	Age-Standardized*
Total	113/2913	3.88	3.32
Farm	52/1329	3.91	3.81
Non-Farm	61/1584	3.85	2.95

*Standardized to 2011 Canadian Census Population

4.3 Research Question 2

4.3.1 Research Question 2a

"Is there an association between rural exposures (occupational i.e. farming and environmental), household musty smell and pesticide application and prostate cancer in rural dwelling men of Saskatchewan?"

Farming job, farming duration and work-place exposure to insecticides and fungicides; and radiation were included as the primary variables of interest in this model. Other candidate variables including age, education, marital status, household income adequacy, household smell, history of cardiovascular diseases, residence, quadrant and source of water were also considered in the model building process based on the results in univariate analysis (Table 4.2 and Table

4.3). Testing for important interactions and assessment for potential confounders were also conducted.

A model with all the independent variables stated above was fit together. An issue of multicollinearity was observed between farming job and farming duration thus giving unstable values. A decision was made to fit the two models separately; one containing farming job only and another containing farming years only (Table 4.5).

Table 4.5 Multivariate Analysis of the Rural Exposures (Occupational and Environmental)

Variables	Model 1		Model 2	
	Adjusted OR (95%CI)	p-value	Adjusted OR (95%CI)	p-value
Farming Job				
Never Farming Job	1.00		-	-
Ever Farming Job	1.37 (0.67, 2.78)	0.39		
Farming Duration				
No Exposure			1.00	
< 30 Years	-	-	1.67 (0.73, 3.78)	0.22
≥ 30 and < 50 Years			1.04 (0.46, 2.33)	0.93
≥ 50 Years			1.42 (0.61, 3.30)	0.41
Age				
≤ 65 Years	1.00		1.00	
> 65 Years	4.15 (2.39, 7.21)	**<0.001**	4.00 (2.12, 7.51)	**<0.001**
Marital Status				
Married, common law or living together	1.00		1.00	
Widowed, divorced, separated or single/never married	2.02 (1.12, 3.64)	**0.02**	1.96 (1.06, 3.62)	**0.03**
Residence				
Non-Farm	1.00		1.00	
Farm	1.83 (1.05, 3.17)	**0.03**	2.08 (1.17, 3.72)	**0.01**
Quadrant				
North West	1.00		1.00	
South West	1.76 (0.83, 3.71)	0.14	1.70 (0.80, 3.60)	0.17
South East	1.78 (0.87, 3.67)	0.12	1.68 (0.81, 3.49)	0.16
North East	1.52 (0.76, 3.02)	0.23	1.35 (0.67, 2.72)	0.40

Household Income Adequacy				
High Income	1.00		1.00	
Middle Income	1.70 (0.93, 3.08)	0.08	1.85 (1.00, 3.44)	**0.05**
Low Income	1.61 (0.83, 3.11)	0.16	1.76 (0.89, 3.50)	0.10
History of Cardiovascular Disease				
No	1.00		1.00	
Yes	1.60 (0.98, 2.63)	0.06	1.57 (0.95, 2.61)	0.08
At work, ever been exposed to Insecticides and Fungicides				
Insect No Fung No	1.00		1.00	
Insect Yes Fung No	1.31 (0.55, 3.15)	0.54	1.41 (0.58, 3.43)	0.45
Insect No Fung Yes	1.01 (0.27, 3.74)	0.98	1.08 (0.29, 4.03)	0.91
Insect Yes Fung Yes	2.27 (1.17, 4.39)	**0.01**	2.40 (1.21, 4.76)	**0.01**
At work, ever been exposed to Radiation				
No	1.00		1.00	
Yes	2.04 (1.09, 3.83)	**0.03**	2.13 (1.12, 4.02)	**0.02**
Water Source				
Bottled Water	1.00		1.00	
Deep Well Water	1.08 (0.55, 2.13)	0.81	1.18 (0.59, 2.35)	0.65
Shallow Well Water	0.53 (0.25, 1.14)	0.10	0.58 (0.27, 1.26)	0.17
Other Source	1.46 (0.77, 2.77)	0.24	1.65 (0.85, 3.21)	0.14

Farming job and quadrant were examined for interaction. The interaction had a p-value of < 0.1 in the model. However, it had extremely wide confidence intervals. Therefore a decision was made to exclude this interaction from the model. Following the model building process described above we ended up with the following two models.

Final model 1:

Log ($\hat{p}$/1-$\hat{p}$) = $\hat{\beta}_0$ + $\hat{\beta}_1$ Residence + $\hat{\beta}_2$ Age + $\hat{\beta}_3$ Marital status + $\hat{\beta}_4$ Quadrant + $\hat{\beta}_5$ Water source+ $\hat{\beta}_6$ Income adequacy + $\hat{\beta}_7$ History of cardiovascular disease + $\hat{\beta}_8$ Work-place exposure to insecticides and fungicides + $\hat{\beta}_9$ Work-place exposure to radiation + $\hat{\beta}_{10}$ **Farming Job** (Table 4.5).

Final model 2:

Log ($\hat{p}$/1-$\hat{p}$) = $\hat{\beta}_0$ + $\hat{\beta}_1$ Residence + $\hat{\beta}_2$ Age + $\hat{\beta}_3$ Marital status + $\hat{\beta}_4$ Quadrant + $\hat{\beta}_5$ Water source+ $\hat{\beta}_6$ Income adequacy + $\hat{\beta}_7$ History of cardiovascular disease + $\hat{\beta}_8$ Work-place exposure to insecticides and fungicides + $\hat{\beta}_9$ Work-place exposure to radiation + $\hat{\beta}_{10}$ **Farming duration** (Table 4.5).

Where p = probability of "self-reported an earlier diagnosis of prostate cancer"

The results indicated that farming job and farming duration were not associated with prostate cancer. However, work-place exposure to insecticides and fungicides together and exposure to radiation were associated with prostate cancer (Table 4.5).

4.3.2 Research Question 2b

"Is there an association between personal smoking history, exposure to household smoke and prostate cancer in rural dwelling men of Saskatchewan?"

The candidate variables of primary interest were personal smoking history and history of smoking pack years. Other predictors including age, education, marital status, household income adequacy, history of cardiovascular diseases, residence, quadrant and source of water supply were also considered for multivariate models given their results at univariate analysis (Table 4.2 and Table 4.3). Testing for important interactions and assessment for potential confounders were also conducted.

To avoid the multicollinearity between personal smoking history and history of smoking pack years, two different models were fit (Table 4.6). Model 1 contained personal smoking

history and a set of covariates whereas model 2 contained history of smoking pack years with the same covariates.

Table 4.6 Multivariate Analysis of the Personal Smoking History and Exposure to Household Smoke

Variables	Model 1		Model 2	
	Adjusted OR (95%CI)	p-value	Adjusted OR (95%CI)	p-value
Personal Smoking History				
Never Smoker				
Ever Smoker	*	*	-	-
History of Smoking Pack Years				
No Exposure				
< 15 Years	-	-	*	*
≥ 15 and < 25 Years				
≥ 25 Years				
Age				
≤ 65 Years	1.00		1.00	
> 65 Years	4.57 (2.69, 7.77)	**<0.001**	4.55 (2.62, 7.91)	**<0.001**
Marital Status				
Married, common law or living together	1.00		1.00	
Widowed, divorced, separated or single/never married	1.80 (1.03, 3.14)	**0.04**	1.77(1.00, 3.18)	**0.05**
Residence				
Non-Farm				
Farm	*	*	*	*

Quadrant				
North West	1.00		1.00	
South West	1.82 (0.90, 3.69)	0.10	1.82 (0.90, 3.72)	0.10
South East	1.74 (0.86, 3.52)	0.12	1.63 (0.80, 3.34)	0.18
North East	1.52 (0.79, 2.92)	0.21	1.35 (0.69, 2.64)	0.38
Household Income Adequacy				
High Income	1.00		1.00	
Middle Income	1.57 (0.89, 2.81)	0.13	1.66(0.90, 3.04)	0.10
Low Income	1.57(0.84, 2.94)	0.16	1.72(0.89, 3.32)	0.11
History of Cardiovascular Disease				
No	1.00		1.00	
Yes	1.49 (0.93, 2.40)	0.10	1.63 (0.99, 2.67)	**0.05**
Water Source				
Bottled Water	1.00		1.00	
Deep Well Water	1.04 (0.55, 1.96)	0.92	1.30 (0.66, 2.55)	0.44
Shallow Well Water	0.54 (0.26, 1.13)	0.10	0.65 (0.30, 1.40)	0.27
Other Source	1.50 (0.83, 2.73)	0.18	1.67 (0.88, 3.17)	0.12
Interactions				
Residence*Personal Smoking History				
Residence * Ever Smokers	3.25 (1.28, 8.25)	**0.01**	-	-
Residence * History of Smoking Pack Years				
Residence *(< 15) Years			3.10 (0.94, 10.19)	0.06
Residence *(≥ 15 and < 25) Years	-	-	4.14 (1.05, 16.25)	**0.04**
Residence *(≥ 25) Years			2.23 (0.57, 8.75)	0.25

* Included in the model but as part of interaction

Residence and personal smoking history; and residence and history of smoking pack years were examined for interaction in model 1 and model 2 respectively. Interaction between farm

residence and ever smokers had a p-value of 0.01 in the model. Interaction between farm residence and (≥ 15 and < 25) smoking pack years had a p-value of 0.04 in model 2. These two interactions were therefore retained in the final models (Table 4.6). The following models were fitted:

Final model 1:

Log ($\hat{p}$/1-$\hat{p}$) = $\hat{\beta}_0$ + $\hat{\beta}_1$ Residence + $\hat{\beta}_2$ Age + $\hat{\beta}_3$ Marital status + $\hat{\beta}_4$ Quadrant + $\hat{\beta}_5$ Water source+ $\hat{\beta}_6$ Income adequacy + $\hat{\beta}_7$ History of cardiovascular disease + $\hat{\beta}_8$ **Personal smoking history** + $\hat{\beta}_9$ Farm* Personal smoking history (Table 4.6).

Final model 2:

Log ($\hat{p}$/1-$\hat{p}$) = $\hat{\beta}_0$ + $\hat{\beta}_1$ Residence + $\hat{\beta}_2$ Age + $\hat{\beta}_3$ Marital status + $\hat{\beta}_4$ Quadrant + $\hat{\beta}_5$ Water source+ $\hat{\beta}_6$ Income adequacy + $\hat{\beta}_7$ History of cardiovascular disease + $\hat{\beta}_8$ **History of smoking pack years** + $\hat{\beta}_9$ Farm* History of smoking pack years (Table 4.6).

The results indicated that the relationship between smoking and prostate cancer depends on whether a person resides on a farm or not. Stratified analysis of this interaction showed that among ever smokers, farm residents have a significantly increased risk of prostate cancer than non-farm residents (Table 4.7). Also, among < 15 pack years smokers and ≥ 15 and < 25 pack years smokers, the risk increased among those residing on a farm than non-farm (Table 4.8).

Table 4.7 Stratified analysis of the personal smoking history as the effect modifier in the relationship between residence and prostate cancer

Variable	Unadjusted OR (95%CI)	p-value	Adjusted OR (95%CI)	p-value
Never Smoker				
Non-Farm	1.00		1.00	
Farm	0.62 (0.34, 1.14)	0.12	0.79 (0.34, 1.84)	0.59
Ever Smoker				
Non-Farm	1.00		1.00	
Farm	1.48 (0.91, 2.40)	0.11	3.63 (1.96, 6.73)	**<0.001**

Table 4.8 Stratified analysis of the history of smoking pack years as the effect modifier in the relationship between residence and prostate cancer

Variable	Unadjusted OR (95%CI)	p-value	Adjusted OR (95%CI)	p-value
No Pack Years Exposure				
Non-Farm	1.00		1.00	
Farm	0.60 (0.33, 1.09)	0.09	0.77 (0.33, 1.76)	0.53
< 15 Pack Years				
Non-Farm	1.00		1.00	
Farm	1.27 (0.58, 2.78)	0.55	3.28 (1.15, 9.34)	**0.03**
≥ 15 and < 25 Pack Years				
Non-Farm	1.00		1.00	
Farm	1.46 (0.55, 3.88)	0.45	6.68 (1.53, 29.27)	**0.01**
≥ 25 Pack Years				
Non-Farm	1.00		1.00	
Farm	0.98 (0.33, 2.86)	0.97	2.99 (0.81, 10.98)	**0.10**

4.3.3 Research question 2c

"Is there an association between age, family history of cancer and prostate cancer in rural dwelling men of Saskatchewan?"

Family history of cancer and age of an individual were the variable of primary interest in multivariate analysis (Table 4.2). Other variables included were education, marital status, household income adequacy, history of cardiovascular diseases, residence, quadrant and source of water supply based on univariate results (Table 4.2 and Table 4.3) and potential confounders and interaction terms.

Table 4.9 Multivariate Analysis of Age and Family History of Cancer

Variables	Adjusted Odds Ratio (95%CI)	p-value
Age		
≤ 65 Years	1.00	
> 65 Years	4.67 (2.74, 7.96)	**<0.001**
Marital Status		
Married, common law or living together	1.00	
Widowed, divorced, separated or single/never married	1.76 (1.0, 3.08)	**0.05**
Residence		
Non-Farm		
Farm	*	*
Quadrant		
North West	1.00	
South West	1.87 (0.92, 3.81)	0.08
South East	1.76 (0.86, 3.56)	0.12
North East	1.56 (0.81, 3.01)	0.19
Household Income Adequacy		
High Income	1.00	
Middle Income	1.15 (0.84, 2.71)	0.17
Low Income	1.60 (0.85, 3.01)	0.14
History of Cardiovascular Disease		
No	1.00	
Yes	1.52 (0.94, 2.45)	0.09

Water Source		
Bottled Water	1.00	
Deep Well Water	1.06 (0.56, 2.02)	0.86
Shallow Well Water	0.53 (0.25, 1.11)	0.09
Other Source	1.53 (0.84, 2.80)	0.17
Family History of Cancer		
No Cancer		
One Cancer		
Two Cancers	*	*
Three or More Cancers		
Do Not Know/Missing		
Interactions		
Residence* Family History of Cancer		
Residence*One Cancer	3.75 (1.03, 13.60)	**0.05**
Residence *Two Cancers	2.29 (0.50, 10.45)	0.29
Residence *Three or More Cancers	5.16 (0.77, 34.69)	**0.09**
Residence *Do Not Know /Missing	2.66 (0.72, 9.82)	0.14

* Included in the model but as part of interaction

Residence and family history of cancer were examined for interaction. The interaction was statistically significant at p-value < 0.1. Therefore, this interaction was retained in the model (Table 4.9). The final model was:

Final model:

Log $(\hat{p}/1-\hat{p})$ = $\hat{\beta}_0$ + $\hat{\beta}_1$ Residence + $\hat{\beta}_2$ Age + $\hat{\beta}_3$ Marital status + $\hat{\beta}_4$ Quadrant + $\hat{\beta}_5$ Water source+ $\hat{\beta}_6$ Income adequacy + $\hat{\beta}_7$ History of cardiovascular disease + $\hat{\beta}_8$ **Family history of cancer** + $\hat{\beta}_9$ Residence*Family history of cancer (Table 4.9).

The results indicated that the family history of cancer modifies the relationship between residence and prostate cancer. Among men having a family history of one cancer, the odds of prostate cancer increased if they resided on a farm than non-farm (Table 4.10).

Table 4.10 Stratified analysis of the family history of cancer as the effect modifier in the relationship between residence and prostate cancer

Variables	Unadjusted OR (95%CI)	p-value	Adjusted OR (95%CI)	p-value
No Cancer				
Non-Farm	1.00		1.00	
Farm	0.82 (0.37, 1.78)	0.61	0.94 (0.35, 2.56)	0.91
One Cancer				
Non-Farm	1.00		1.00	
Farm	1.29 (0.63, 2.64)	0.48	4.32 (1.59, 11.97)	**<0.001**
Two Cancers				
Non-Farm	1.00		1.00	
Farm	1.03 (0.36, 2.89)	0.96	3.59 (0.61, 21.24)	0.16
Three or More Cancers				
Non-Farm	1.00		1.00	
Farm	1.37(0.41, 4.61)	0.61	2.02 (0.27, 15.22)	0.50
Do Not Know/Missing				
Non-Farm	1.00		1.00	
Farm	0.92 (0.42, 2.00)	0.83	2.25 (0.82, 6.22)	0.12

4.4 Research Question 3

"Is family history of cancer an effect modifier in the relationship between rural exposures (occupational i.e. farming and environmental) and prostate cancer in rural dwelling men of Saskatchewan?"

Primary candidate variables that were included in this analysis were farming job, farming duration, personal smoking history, history of smoking pack years. Again a decision was made to fit four different models containing possible combinations of these four variables to avoid the issue of multicolinearity (Table 4.11). Remaining variables that were included in each of these models were age, marital status, residence, quadrant, household income adequacy, history of cardiovascular disease, work place exposure, water source and family history of cancer. The inclusion of candidate variables was based on results from research question 2.

Table 4.11 Multivariate analysis of the potential risk factors of prostate cancer

Independent Variable	Model 1		Model 2		Model 3		Model 4	
	Adjusted OR (95%CI)	p-value	Adjusted OR (95%CI)	p-value	Adjusted OR (95%CI)	p-value	Adjusted OR (95%CI)	p-value
Farming Job								
Never Farming Job	1.00		-	-	1.00		-	-
Ever Farming Job	1.38 (0.68, 2.81)	0.38			1.22 (0.59, 2.53)	0.59		
Farming Duration								
No Exposure			1.00				1.00	
< 30 Years	-	-	1.48 (0.64, 3.44)	0.36			1.60 (0.70, 3.67)	0.26
≥ 30 and < 50 Years			0.95 (0.41, 2.20)	0.91	-	-	1.11 (0.49, 2.49)	0.80
≥ 50 Years			1.25 (0.52, 3.00)	0.62			1.57 (0.67, 3.68)	0.30
Personal History of Smoking								
Never Smoker								
Ever Smoker	*	*	-	-	-	-	*	*
Personal History of Smoking Pack Years								
No Exposure								
< 15 Years	-	-	*	*	*	*	-	-
≥ 15 and < 25 Years								
≥ 25 Years								
Age								
≤ 65 Years	1.00		1.00		1.00		1.00	
> 65 Years	4.27 (2.45, 7.45)	**<0.001**	4.28 (2.22, 8.25)	**<0.001**	4.25 (2.38, 7.58)	**<0.001**	3.84 (2.04, 7.25)	**<0.001**

Marital Status								
Married, common law or living together	1.00		1.00		1.00		1.00	
Widowed, divorced, separated or single/never married	2.29 (1.25, 4.417)	**<0.001**	2.31 (1.22, 4.53)	**0.01**	2.22 (1.19, 4.15)	**0.01**	2.28 (1.22, 4.26)	**0.01**
Residence								
Non-Farm								
Farm	*	*	*	*	*	*	*	*
Quadrant								
North West	1.00		1.00		1.00		1.00	
South West	1.80 (0.85, 3.84)	0.12	1.75 (0.82, 3.74)	0.15	1.80 (0.84, 3.83)	0.13	1.74 (0.82, 3.71)	0.15
South East	1.75 (0.84, 3.66)	0.14	1.55 (0.73, 3.31)	0.25	1.65 (0.79, 3.48)	0.18	1.62 (0.77, 3.41)	0.20
North East	1.54 (0.76, 3.11)	0.20	1.25 (0.60, 2.59)	0.55	1.37 (0.67, 2.80)	0.39	1.37 (0.67, 2.79)	0.38
1Household Income Adequacy								
High Income	1.00		1.00		1.00		1.00	
Middle Income	1.79 (0.97, 3.28)	0.06	2.04 (1.07, 3.90)	**0.03**	1.96 (1.04, 3.68)	**0.04**	1.98 (1.06, 3.71)	**0.03**
Low Income	1.71 (0.88, 3.33)	0.11	1.88 (0.91, 3.89)	0.09	1.86 (0.92, 3.76)	0.09	1.85 (0.92, 3.69)	0.08
History of Cardiovascular Disease								
No	1.00		1.00		1.00		1.00	
Yes	1.66 (1.01, 2.75)	**0.05**	1.78 (1.04, 3.02)	**0.03**	1.87 (1.12, 3.18)	**0.02**	1.68 (1.00, 2.80)	**0.05**

At work, ever been exposed to Insecticides and Fungicides								
Insect No Fung No	1.00		1.00		1.00		1.00	
Insect Yes Fung No	1.35 (0.56, 3.26)	0.50	1.21 (0.48, 3.07)	0.68	1.13 (0.45, 2.82)	0.79	1.40 (0.57, 3.43)	0.46
Insect No Fung Yes	0.92 (0.24, 3.47)	0.90	0.69 (0.14, 3.34)	0.65	0.62 (0.13, 2.95)	0.55	1.02 (0.27, 3.86)	0.98
Insect Yes Fung Yes	2.28 (1.17, 4.43)	**0.02**	2.49 (1.24, 5.02)	**0.01**	2.26 (1.15, 4.46)	**0.02**	2.39 (1.20, 4.76)	**0.01**
At work, ever been exposed to Radiation								
No	1.00		1.00		1.00		1.00	
Yes	1.93 (1.01, 3.72)	**0.05**	1.95 (0.99, 3.86)	**0.05**	1.95 (1.00, 3.81)	**0.05**	2.02 (1.05, 3.89)	**0.04**
Water Source								
Bottled Water	1.00		1.00		1.00		1.00	
Deep Well Water	1.03 (0.52, 2.06)	0.93	1.41 (0.67, 2.97)	0.36	1.26 (0.62, 2.59)	0.52	1.12 (0.55, 2.29)	0.75
Shallow Well Water	0.56 (0.26, 1.20)	0.14	0.72 (0.32 1.63)	0.43	0.65 (0.29, 1.44)	0.29	0.59 (0.27, 1.29)	0.19
Other Source	1.52 (0.79, 2.92)	0.21	1.83 (0.89, 3.75)	0.10	1.54 (0.78, 3.07)	0.21	1.62 (0.83, 3.19)	0.16
Family History of Cancer								
No Cancer								
One Cancer								
Two Cancers								
Three or More Cancers	*	*	*	*	*	*	*	*
Do Not Know/Missing								

Interactions								
Residence*History of Personal Smoking								
Residence*Ever Smokers	5.19 (1.91, 14.11)	**<0.001**	-	-	-	-	4.74 (1.72, 13.09)	**<0.001**
Residence * History of Smoking Pack Years								
Residence*(< 15 Years)			4.86 (1.32, 17.86)	**0.02**	4.26 (1.22, 14.91)	**0.02**		
Residence*(≥ 15 and < 25 Years)	-	-	6.75 (1.52, 29.97)	**0.01**	6.98 (1.59, 30.57)	**0.01**	-	-
Residence*(≥ 25 Years)			2.90 (0.66, 12.64)	0.16	3.23 (0.75, 13.93)	0.12		
Residence* Family History of Cancer								
Residence*One Cancer	3.36 (0.89, 12.66)	**0.07**						
Residence*Two Cancers	1.75 (0.35, 8.62)	0.49						
Residence*Three or More Cancers	4.52 (0.63, 32.46)	0.13						
Residence*Do Not Know /Missing	4.06 (0.97, 17.04)	**0.06**	-	-	-	-	-	-

* Included in the model but part of interaction

In addition to the interactions that were significant and were considered in research question 2, other interactions specific to research question 3 were examined. Interactions such as family history of cancer and work place exposure to insecticides and fungicides; family history of cancer and work place exposure to radiation, family history of cancer and water source, family history of cancer and personal history of smoking were examined. However, none of these interactions contributed significantly to the final models. The final models were as follows:

Final model 1:

Log ($\hat{p}$/1-$\hat{p}$) = $\hat{\beta}_0$ + $\hat{\beta}_1$ Residence + $\hat{\beta}_2$ Age + $\hat{\beta}_3$ Marital status + $\hat{\beta}_4$ Quadrant + $\hat{\beta}_5$ Water source+ $\hat{\beta}_6$ Income adequacy + $\hat{\beta}_7$ History of cardiovascular disease + $\hat{\beta}_8$ Work place exposure to insecticides and fungicides + $\hat{\beta}_9$ Work-place exposure to radiation + $\hat{\beta}_{10}$ **Farming job** + $\hat{\beta}_{11}$ **Personal smoking history** + $\hat{\beta}_{12}$ family history of cancer + $\hat{\beta}_{13}$ Residence*Personal smoking history + $\hat{\beta}_{14}$ Farm*Family history of cancer (Table 4.11).

Final model 2:

Log ($\hat{p}$/1-$\hat{p}$) = $\hat{\beta}_0$ + $\hat{\beta}_1$ Residence + $\hat{\beta}_2$ Age + $\hat{\beta}_3$ Marital status + $\hat{\beta}_4$ Quadrant + $\hat{\beta}_5$ Water source+ $\hat{\beta}_6$ Income adequacy + $\hat{\beta}_7$ History of cardiovascular disease + $\hat{\beta}_8$ Work place exposure to insecticides and fungicides + $\hat{\beta}_9$ Work-place exposure to radiation + $\hat{\beta}_{10}$ **Farming duration** + $\hat{\beta}_{11}$ **History of smoking pack years** + $\hat{\beta}_{12}$ Family history of cancer + $\hat{\beta}_{13}$ Residence*History of smoking pack years (Table 4.11).

Final model 3:

Log ($\hat{p}$/1-$\hat{p}$) = $\hat{\beta}_0$ + $\hat{\beta}_1$ Residence + $\hat{\beta}_2$ Age + $\hat{\beta}_3$ Marital status + $\hat{\beta}_4$ Quadrant + $\hat{\beta}_5$ Water source+ $\hat{\beta}_6$ Income adequacy + $\hat{\beta}_7$ History of cardiovascular disease + $\hat{\beta}_8$ Work place exposure to insecticides and fungicides + $\hat{\beta}_9$ Work-place exposure to radiation + $\hat{\beta}_{10}$ **Farming job** + $\hat{\beta}_{11}$ **History of smoking pack years** + $\hat{\beta}_{12}$ Family history of cancer + $\hat{\beta}_{13}$ Residence*History of smoking pack years (Table 4.11).

Final model 4:

Log ($\hat{p}$/1-$\hat{p}$) = $\hat{\beta}_0$ + $\hat{\beta}_1$ Residence + $\hat{\beta}_2$ Age + $\hat{\beta}_3$ Marital status + $\hat{\beta}_4$ Quadrant + $\hat{\beta}_5$ Water source+ $\hat{\beta}_6$ Income adequacy + $\hat{\beta}_7$ History of cardiovascular disease + $\hat{\beta}_8$ Work place exposure to insecticides and fungicides + $\hat{\beta}_9$ Work-place exposure to radiation + $\hat{\beta}_{10}$ **Farming duration** + $\hat{\beta}_{11}$ **Personal smoking history** + $\hat{\beta}_{12}$ Family history of cancer + $\hat{\beta}_{13}$ Residence*Personal smoking history (Table 4.11).

The results indicated that farming job and farming duration has no relationship with prostate cancer (Table 4.11). However, work place exposure to insecticides fungicides and radiation were significantly associated with prostate cancer and showed a greater risk among exposed groups. Personal smoking history (Table 4.12 and Table 4.16) and history of smoking pack years (Table 4.14 and Table 4.15) were the effect modifiers in the relationship of residence and prostate cancer. Family history of cancer was observed to modify the association between residence and prostate cancer (Table 4.13).

Table 4.12 Stratified analysis of the personal smoking history as the effect modifier in the relationship between residence and prostate cancer in the final model 1

Variable	Unadjusted OR (95%CI)	p-value	Adjusted OR (95%CI)	p-value
Never Smoker				
Non-Farm	1.00		1.00	
Farm	0.62 (0.34, 1.14)	0.12	0.44 (0.17, 1.15)	**0.09**
Ever Smoker				
Non-Farm	1.00		1.00	
Farm	1.48 (0.91, 2.40)	0.11	4.04 (1.96, 8.34)	**<0.001**

Table 4.13 Stratified analysis of the family history of cancer as the effect modifier in the relationship between residence and prostate cancer in the final model 1

Variable	Unadjusted OR (95%CI)	p-value	Adjusted OR (95%CI)	p-value
No Cancer				
Non-Farm	1.00		1.00	
Farm	0.82 (0.37, 1.78)	0.61	0.84 (0.28, 2.52)	0.75
One Cancer				
Non-Farm	1.00		1.00	
Farm	1.29 (0.63, 2.64)	0.48	3.41 (1.09, 10.62)	**0.03**
Two Cancers				
Non-Farm	1.00		1.00	
Farm	1.03 (0.36, 2.89)	0.96	1.36 (0.19, 9.84)	0.76
Three or More Cancers				
Non-Farm	1.00		1.00	
Farm	1.37(0.41, 4.61)	0.61	1.67 (0.13, 21.89)	0.69
Do Not Know/Missing				
Non-Farm	1.00		1.00	
Farm	0.92 (0.42, 2.00)	0.83	4.84 (1.20, 19.55)	**0.03**

Table 4.14 Stratified analysis of the history of smoking pack years as the effect modifier in the relationship between residence and prostate cancer in the final model 2

Variable	Unadjusted OR (95%CI)	p-value	Adjusted OR (95%CI)	p-value
No Pack Years Exposure				
Non-Farm	1.00		1.00	
Farm	0.60 (0.33, 1.09)	0.09	0.52 (0.19, 1.42)	0.20
< 15 Pack Years				
Non-Farm	1.00		1.00	
Farm	1.27 (0.58, 2.78)	0.55	5.60 (1.50, 20.83)	**0.01**
≥ 15 and < 25 Pack Years				
Non-Farm	1.00		1.00	
Farm	1.46 (0.55, 3.88)	0.45	29.89 (2.21, 404.40)	**0.01**
≥ 25 Pack Years				
Non-Farm	1.00		1.00	
Farm	0.98 (0.33, 2.86)	0.97	4.88 (0.84, 28.17)	**0.08**

Table 4.15 Stratified analysis of the history of smoking pack years as the effect modifier in the relationship between residence and prostate cancer in the final model 3

Variable	Unadjusted OR (95%CI)	p-value	Adjusted OR (95%CI)	p-value
No Pack Years Exposure				
Non-Farm	1.00		1.00	
Farm	0.60 (0.33, 1.09)	0.09	0.47 (0.18, 1.21)	0.12
< 15 Pack Years				
Non-Farm	1.00		1.00	
Farm	1.27 (0.58, 2.78)	0.55	3.64 (1.05, 12.60)	**0.04**
≥ 15 and < 25 Pack Years				
Non-Farm	1.00		1.00	
Farm	1.46 (0.55, 3.88)	0.45	15.33 (1.69, 139.34)	**0.02**
≥ 25 Pack Years				
Non-Farm	1.00		1.00	
Farm	0.98 (0.33, 2.86)	0.97	4.97 (0.89, 27.58)	**0.07**

Table 4.16 Stratified analysis of the personal smoking history as the effect modifier in the relationship between residence and prostate cancer in the final model 4

Variable	Unadjusted OR (95%CI)	p-value	Adjusted OR (95%CI)	p-value
Never Smoker				
Non-Farm	1.00		1.00	
Farm	0.62 (0.34, 1.14)	0.12	0.45 (0.16, 1.28)	0.14
Ever Smoker				
Non-Farm	1.00		1.00	
Farm	1.48 (0.91, 2.40)	0.11	4.36 (2.05, 9.30)	**<0.001**

The Hosmer-Lemeshow (HL) statistic was used to assess the goodness of fit of the model. The p-value of the HL statistic for (i) model 1 = 0.32 (ii) model 2 = 0.73 (iii) model 3 = 0.41 and (iv) model 4 = 0.84, indicating that all the models were good fit and were acceptable.

CHAPTER 5: DISCUSSION

The Saskatchewan Rural Health Study is a large prospective cohort study. To date, baseline data has been collected. This baseline data was the basis of this thesis which assessed the prevalence of prostate cancer (among men older than 45 years) and the risk factors associated with it. This secondary data analysis used "the Population Health Framework" to answer the research questions.

5.1 Summary and Interpretation of Results

In total 114 men reported having prostate cancer where as 2,824 men did not have prostate cancer. The majority of prostate cancer cases were among men older than 65 years of age compared to non-cases. A similar proportion of cases and non-cases resided on farm. Men with prostate cancer tended to have low income families as compared to their counterparts.

The overall crude prevalence of prostate cancer was 3.9%. The overall age standardized prevalence in 2010-2011 was 3.3%. It was observed that the farm dwelling (3.8%) and non-farm dwelling prevalence (3.0%) of prostate cancer was not statistically different from each other. To our knowledge in the given literature, none of the Canadian studies attempted to report one year prevalence of prostate cancer in rural population but focused rather on incidence and mortality. However, in a report by Ellison and Wilkins, two-year prostate cancer prevalence in the Canadian population on January 1, 2005 was 236.0 per 100,000 (5). They utilized cancer registries to obtain diagnosed cases whereas the current study utilized a survey to obtain prostate cancer cases.

We hypothesized that the farming occupation and farming duration would be associated with prostate cancer and would show an increased risk among farmers. Based on univariate analysis, it was observed that men who ever had a farming job were at an increased risk of prostate cancer. However, when adjusted for other risk factors the association between "ever had a farming job" and prostate cancer was not statistically significant. Men who had farming exposure for < 30 years and ≥ 50 years also showed an increased risk as compared to men with no farming years exposure. However, this relationship was not statistically significant when adjusted for other risk factors. Thus, our data fails to support our hypothesis. Our findings thus do not confirm that farming occupation or duration of farming is a risk factor for prostate cancer in the rural population of Saskatchewan. Our findings were consistent with other studies (63-66)

concluding that farming or agricultural occupations were not associated with prostate cancer. Yet, there remains some inconsistency in the literature where a few studies have reported an increased risk among farmers (9, 15-18, 53).

Increasing years of farming and prostate cancer did not show any dose response relationship (17, 67) thus supporting our results. Our results suggested that prostate cancer was significantly associated with work place exposures such as insecticides and fungicides taken together; and exposure to radiation. With regards to occupational exposures to pesticides and radiation our findings were similar to other studies (19-23).

Many factors could possibly provide explanation for these inconsistencies in results. A review by Gulden and Vogelzang (18) suggested that difference in farming practices among countries and even regions could change the nature and intensity of exposure. They also suggested that some studies tended to misclassify cases that previously held farming occupation as non-farmers. However in the current study, participants who "ever had a farming job" during their lifetime were considered as farmers. Another possibility is the inclusion of African Americans in previous studies.

Occupation and lifestyle (including diet) of an individual have been linked (15). This may contribute to these differences in results. As cited by Parent and Siemiatycki (15), Iowa farmers had different lifestyles including smoking, alcohol drinking and consumption of calories etc. as compared to non-farmers. Therefore, researchers suggested considering lifestyle as a confounding issue to farming occupation to estimate the risk of prostate cancer. In our analyses, we adjusted for many confounders.

The use of agricultural chemicals is suspected to be carcinogenic in some previous studies (19-22). Chemical compounds including methyl bromide, organochlorine and cadmium are suggested to have a biologic role in prostate carcinogenesis (21-22). For instance, cadmium that is used as an active ingredient in pesticides intervenes with the ability of human body to absorb zinc whose adequate levels in the body are considered to have a protective effect against prostate cancer (68). Cadmium has the ability to pass through skin when it is exposed to contaminated soil and water. Exposure to pesticides is associated with farming occupation. In the current study, it was surprising to observe that the work place exposure to insecticides and fungicides had an association with prostate cancer but farming job did not. It may suggest that specific chemical compounds in insecticides and fungicides may have contributed to the increased risk of

prostate cancer. Even though exposure to radiation was observed to be associated with prostate cancer, it cannot be confirmed as to what specific kinds of radiation these men were exposed to at their work place that increased the risk of prostate cancer. Outdoor workers such as farmers, mechanics, gardeners, roofers, construction workers and laborers are exposed to Ultraviolet (UV) radiations (69). These UV rays coming from the Sun, welding torches and hot metal operations have enough energy to destroy DNA (deoxyribonucleic acid) cells and to cause cancer (70).

The current study also assessed the relationship between household pesticide application and prostate cancer. This relationship was not statistically significant at the univariate level thus it did not progress to the multivariate stage. Also, household musty smell, despite contributing significantly in the univariate analysis did not contribute significantly to the prediction of prostate cancer in multivariate analysis when adjusting for others set of variables.

The source of drinking water was observed to be associated with residence and prostate cancer. It suggests that people residing on farms use wells as their major source of drinking water. It is well known (71) that on farms when pesticides are applied on fields, it gets absorbed by ground soil and eventually ends up in ground water making it contaminated for farm residents who rely on wells for drinking purposes.

In conclusion, our hypothesis that rural exposures (occupational i.e. farming and environmental) were associated with prostate cancer in rural dwelling men of Saskatchewan was supported by our results.

It is known that cigarette smoke contains several carcinogens (27). Chemical compounds such as polycyclic aromatic hydrocarbons, heterocyclic aromatic amines, and nitrosamine through cigarette smoke could promote carcinogenesis in the prostate (72). Smoking may influence the hormonal factors in a human body. An increased level of hormones (androsterone and testosterone) in male smokers was found to increase the risk of prostate cancer (73). Besides, cigarette smokers have lower insulin-like growth factor (IGF)-I and IGF binding protein-3 (IGFBP-3) serum concentrations that are associated with prostate cancer (74-75). Our study also investigated the association between household smoke, personal smoking history of an individual and prostate cancer. Our results indicated that the risk of prostate cancer for farm and non-farm residents depend on whether they ever smoked or not. In other words it can be said that ever smokers who resided on a farm were at a higher risk than non-farm residents. Similarly, with increasing smoking pack years exposure (< 15 pack years and ≥ 15 and < 25 pack years) risk also

increased among farm residents, although the risk increased and then decreased with the duration of pack years indicating a healthy survivor effect. It may suggest that the men who smoked ≥ 25 pack years were much healthier and their genetic constitution made them less susceptible to prostate cancer or the effects of smoking. They may also have a healthier lifestyle that promotes healthier levels of hormones thus reducing risk of cancer (76).

We hypothesized that the exposure to personal smoking and pack years would be associated with prostate cancer. Our data supported this hypothesis and showed an increased risk among smokers residing on a farm. The current study suggested that personal smoking history may not be independently associated with prostate cancer. However, it was an effect modifier meaning increased the risk of prostate cancer for those who lived on farm but not non-farm dwellers. The results from the current study were similar to other studies (27, 30) indicating an association between smoking and prostate cancer but were different from some other studies (28, 29). Another study also showed a dose-response relationship between smoking intensity and risk of prostate cancer (30). Some of the reasons to observe these differences in reported findings could be the differences in study populations. Firstly, the SRHS study included a population from Saskatchewan; Canada (developed country) that is known to be a high risk population. However, one of the studies (28) included Singapore Chinese population known to be a low risk population. Secondly, the Singapore study was a prospective study that included non-cases at the baseline and followed them over time whereas the current study was a cross-sectional study and the participants already had prostate cancer at the time of data collection. Thirdly, the Chinese cohort included men aged 45-74 years as compared to the current study that included men aged older than 45 years. Moreover the Chinese cohort appeared to include urban men as well whereas the current study included a rural population only. Another study was focused on US veterans aged 31-84. These differences in population characteristics could also result in difference in study findings (29).

Cancer can be caused by abnormal functioning of the gene (pieces of DNA) that passes from one generation to another through egg or sperm (77). Other known risk factors of primary interest for prostate cancer (i.e. age of an individual and family history of cancer) were investigated. Age showed a consistent and strong association with the outcome confirming that men who were older than 65 years of age were at an increased risk of prostate cancer. The results also indicated that family history of cancer was associated with the outcome of interest. Family

history of cancer significantly modified the relationship between residence and prostate cancer. It was observed that among men who had a family history of one cancer, farm residents were at a higher risk of prostate cancer than non-farm residents. Thus, our results supported the hypothesis that age of an individual and family history of cancer is associated with prostate cancer in rural dwelling men of Saskatchewan. The increase in risk of prostate cancer among men with a positive family history of cancer was also observed in some other studies (78-79). It was observed that men with a family history of any cancer in first degree male relatives were more likely to be at increased risk (78). In another study conducted in Shanghai, similar trends of an increased risk for prostate cancer was observed in men whose first degree relatives had any cancer (79). An Italian study also observed that in first degree relatives, family history of cancer at all sites was related to risk of prostate cancer (80). However, some studies were unable to find such associations (81-82). The inconsistency between studies may result from differences in study populations and their genetic constitution.

Other variables were also included in the analysis as confounders. Our findings were consistent with other studies (83-84) investigating similar association and suggested that men who had a history of cardiovascular disease were more at risk of prostate cancer. Men who were either divorced or separated were at an increased risk of prostate cancer than married men (85).

5.2 Study Strengths and Limitations

5.2.1 Study Strengths

The current study determined the baseline prevalence and risk factors associated with prostate cancer among rural dwelling men of Saskatchewan. Quantitative data obtained from the survey questionnaires with the study participants were analyzed using sound statistical techniques. The study has strengths that are worth mentioning. Our study was based on the concept of the population health framework that was used successfully for a similar injury cohort (86). The SRHS team was successful in collecting data on a large number of participants in a rural setting using Dillman's method. Detailed information on individual factors, household factors and contextual factors including covariates was collected. The SRHS was able to collect extensive information on lifetime occupational history, a variety of work-place exposures including pesticides, smoking history and family history of cancer.

The study population was from all four quadrants of southern half of rural Saskatchewan (North-East, South-East, North-West, and South-West) to best cover the possible geographical areas of Saskatchewan. This reduced the possibility of bias that might have been introduced by including one quadrant.

The SRHS used an interdisciplinary approach in which researchers from various disciplines such as nursing, geography, medicine and epidemiology pooled their approaches and expertise. In collaboration with rural municipality council members and small town council members, the SRHS team held annual dissemination and planning meetings.

Self-administered mail surveys were used to collect the information from participants. An adult member of the family was asked to provide all the individual and household details. A pilot project was conducted to test the recruitment strategies and quality of baseline questionnaire for the main study.

Our results provided a strong association (odds ratio) between risk factors and prostate cancer. Exposure to smoking pack years showed a statistically significant dose-response relationship. All our results were consistent with some but not all studies in given literature, were plausible based on the current literature thus adding to it.

Apart from the causal explanations, our study attempted to reduce the possibility of confounding by adjusting for number of other factors in the multivariate analysis. In order to evaluate the role of chance on results, appropriate statistical tests were performed.

5.2.2 Study Limitations

There are also some limitations of this study. First the study population consisted of approximately 97% Caucasians; hence despite ethnicity being an established risk factor for prostate cancer, this link could not be investigated. An advantage of this was that confounding by ethnic background was minimized.

With respect to external validity of the current study, findings should not be generalized to an urban population since the population in this study consisted of rural residents. Also one should keep in mind that the majority of the study population was Caucasians. However, we are certain that the results can be generalized when compared to other parts of rural Canada where farming practices and characteristics of the population are more or less similar to Saskatchewan.

The current study also could not confirm the pathology of the prostate cancer due to lack of information.

The response rate of this study was approximately 42%. This can be considered a moderate response rate. An increased number of participants would increase statistical power allowing a better investigation of interactions. However, with this sample size, our study was still able to examine the relationship between various risk factors, prostate cancer and the interactions between them.

The current study was a cross sectional study and therefore, temporality could not be established. There is also some concern of recall bias as the study questionnaires included questions regarding the past exposures. However, because this was a secondary analysis of a dataset aimed at investigating lung health, participants were not aware of the outcome of interest we were interested in. Therefore, we assume that there was less chance of differential misclassification by people inaccurately classifying their past exposure such as exposure to pesticides, grain dust, wood dust and other occupational exposures.

With regards to work place exposure and outcome assessment, misclassification is likely non-differential in this study of secondary analysis because participants asked to complete the questionnaire had no knowledge regarding the outcome of interest i.e. prostate cancer. This type of bias occurs at random and is known to have small effect on the true relationship of interest and bias towards the null.

We were also interested in looking at the dose response relationship between prostate cancer and the duration of years men were exposed to pesticides and radiation at work. Due to the large missing values this link could not be investigated. However, the current study was able to investigate such associations for history of personal smoking, smoking pack years and family history of cancer.

5.3 Recommendations

The observational study design such as a cross-sectional design can only hypothesize the relationship between a risk factor and outcome and cannot be used to establish causality; therefore in the future, case-control and longitudinal study designs should be conducted. With a small population in prostate cancer we were able to find some associations with certain occupational exposures, family history of cancer and prostate cancer; however, to completely test

the results from the current study, a larger study with a large enough sample of prostate cancer cases is required in future that would enable the researchers to test the hypothesis with adequate statistical power.

As the majority of the sample population was Caucasian, a possible role of ethnicity could not be investigated in this study, but given the importance of this risk factor in the literature we would recommend to examine this association in a Saskatchewan population in future.

The Saskatchewan Rural Health Study was aimed to assess respiratory illnesses among a rural population. Even though the risk factors that were hypothesized in the beginning of the current study were available for this study, we would suggest to researchers to collect and investigate the prostate cancer link exclusively focusing on it. This could be done in the data collection phase. Another suggestion would be the use of some biological markers in order to measure the exposure objectively allowing for accurate results.

A trend was observed for men having work place exposure to insecticides, fungicides and radiation to have an increased risk of prostate cancer. Future studies should obtain detailed information on types of chemical compounds used in such pesticides and different types of radiations farmers are exposed to. This may provide a better link as to what chemical compounds trigger the growth of the prostate cancer.

Personal smoking history acted as an effect modifier between residence and prostate cancer. Ever smokers who lived on a farm were at an increased of prostate cancer. This indicates that chemicals found in cigarette may interact with the chemicals present on farm due to pesticide application. This potential link should be investigated in rural population as well as general populations.

Health care utilization and its access could have an effect on the early diagnosis of prostate cancer. Whether the population is rural or urban, they would have varied access to health care, services and utilization. Population that do not regularly access these services are not availing their chance of being diagnosed with the prostate cancer at an early stage. This could thus underestimate the prevalence of prostate cancer. Future researchers should assess the potential role of access to health care services in their study.

5.4 Conclusion

The results of the current study do not support a relationship between farming occupation, farming duration, household pesticide application, household musty smell and prostate cancer. However, there was statistically significant association that indicated that men who had work place exposure to a combination of insecticides and fungicides; and radiation were at an increased risk of prostate cancer than non-exposed men. Personal smoking history, smoking pack years and family history of cancer modified the relationship between residence and prostate cancer. Source of drinking water acted as a confounder between the primary relationship of farm residence and prostate cancer. Age significantly contributed to the prevalence of prostate cancer.

Our study was able to identify the prevalence of prostate cancer and its potential risk factors in rural men (older than 45 years) of Saskatchewan. The results may help research professionals by directing the focus of their research towards rural population examining prostate cancer.

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Appendix A: Survey Questionnaire

SASKATCHEWAN RURAL HEALTH STUDY

UNIVERSITY OF SASKATCHEWAN

TO MEMBERS OF THE HOUSEHOLD AND THEIR FAMILIES:

The University of Saskatchewan is conducting this project to learn more about the health of rural dwellers in Saskatchewan. Families from across Saskatchewan are participating.

This questionnaire is our first contact with your family. Please have an adult family member complete this part of the questionnaire. Please try to answer all of the questions, but remember you don't have to answer any questions if you choose not to. When you have finished, place the questionnaire in the enclosed stamped envelope and mail it back to us at the University.

Instructions

1. Please have an adult family member (age 18 or over) complete Section A and Section B of this questionnaire.

   In Section B of this form, we have asked questions about each adult member (age 18 or over) of your family. We have included enough space in this booklet for 2 adults.

   If you have more than 2 adult family members living in your home, PLEASE COMPLETE "Section B" IN THE GREEN BOOKLET for each additional adult.

2. Please read each question carefully.

3. Answer each question by placing a check mark in the box provided. For some questions you will need to write in the space provided. Thank you for taking part in this important study.

4. **Please be sure to complete the last page.**

The University of Saskatchewan

Sponsored by the Canadian Institutes of Health Research (Canada's main funder of medical research)

SECTION A YOUR HOME

PLEASE ANSWER THE FOLLOWING QUESTIONS ABOUT YOUR PRIMARY FAMILY HOME - THAT IS THE HOME WHERE YOU LIVE MOST OF THE TIME.

Today's Date: _____/_____/_____
(Day / Month / Year)

DEMOGRAPHICS

A-1 Where is your home located?
- c Farm
- c In town
- c Acreage, please specify number of acres _____

A-2 How many people live in your home?
_____ Number

A-3 Please list all persons who usually live here including yourself.

Age	Sex	Family Member
	M c F c	Yes c No c
	M c F c	Yes c No c
	M c F c	Yes c No c
	M c F c	Yes c No c
	M c F c	Yes c No c
	M c F c	Yes c No c

(*IF MORE SPACES ARE REQUIRED CONTINUE ON THE BACK OF THE QUESTIONNAIRE*.)

A-4 How many bedrooms do you have in your home?
_____ Number

A-5 Do you own your home?
- c Yes
- c No
- c Don't know

LIVING ENVIRONMENT

A-6 What year was your residence/apartment built (approximately)?

Year_____ Don't know c

A-7 What are the types of fuel sources used to heat your home? **Please check all that apply.**

	Primary	Secondary
c Natural Gas	c	c
c Propane	c	c
c Electricity	c	c
c Fuel oil	c	c
c Coal	c	c
c Geo-thermal	c	c
c Solar energy	c	c
c Wood	c	c
➥ If yes, do you use: c Fireplace c Free standing wood stove c Fireplace insert c Outdoor wood stove		
c Other	c	c
Please specify _____		
c Don't Know		

A-8 Does your heating system have a filter?
- c Yes
- c No
- c Don't Know

A-9 Does your home have air conditioning?
- c Yes → **If yes, please check one:** c Central c Room c Both
- c No
- c Don't Know

A-10 Is a humidifier or vaporizer used in your home?
- c Yes
- c No
- c Don't Know

A-11 Do you use a dehumidifier in your home?
- c Yes
- c No
- c Don't Know

A-12 On average, how often per month:
do you vacuum carpet? ____ times per month
do you mop smooth floors? ____ times per month
do you dry dust clean? _____ times per month do you wet dust clean? _____ times per month

A-13 During the <u>past 12 months</u>, has there been water or dampness in your home from broken pipes, leaks, heavy rain, or floods?
- c Yes
- c No
- c Don't Know

A-14 Does your home (including basement) frequently have a mildew odor or musty smell?

c Yes
c No
c Don't Know

A-15 In the past 12 months have you had any of the following pets living in your home? **Please check Yes or No for each type of pet.**

c Check here if you do not have any pets in the house.

	Yes	No	Don't Know
Cat	c	c	c
Dog	c	c	c
Bird	c	c	c
Any other pet	c	c	c

If Yes, please specify _____

A-16 Within the past 12 months, were pesticides (including herbicides, insecticides, fungicides, rodenticides, fumigants) applied inside your residence (e.g., raid, spider bait, ant bait, rat bait)?

c Yes → **If Yes, what pesticide(s)? Please specify**_____
c No
c Don't Know

A-17 Do any of the people who live in your house use any of the following tobacco products in the home? **Please answer Yes or No for each product.**

	Yes	No	Don't Know
Cigarettes	c	c	c
Cigars	c	c	c
Pipes	c	c	c

A-18 **If yes to cigarettes,** how many persons smoke cigarettes in your home?

_____ number of persons

A-19 **If yes to cigarettes,** how many cigarettes do they smoke per day in total?

_____ number of cigarettes

A-20 What is your best estimate of the total income, before taxes and deductions, of all household members from all sources in the past 12 months?

c Less than $14,999
c $15,000 to $19,999
c $20,000 to $29,999
c $30,000 to $39,999
c $40,000 to $49,999
c $50,000 to $59,999
c $60,000 to $79,999
c $80,000 or more

A-21 At the end of the month, how much money do you have left over? **(Please check only one)**

c Some money
c Just enough money
c Not enough money

ACCESS TO HEALTH CARE

A-22 Do you and your family members in your household have access to a regular family doctor or nurse practitioner?

c Yes
c No
c Don't Know

A-23 In the past 12 months did you ever experience any difficulties getting the routine or on-going care you or a family member in your household needed?

c Yes
c No
c Don't Know

A-24 In the past 12 months, have you required a visit to a medical specialist for a diagnosis or consultation for yourself or a family member in your household?

c Yes
c No → **If No, go to question A-28.**
c Don't Know

A-25 In the past 12 months did you ever experience any difficulty getting the specialist care you needed for a diagnosis or consultation for yourself or

a family member in your household?

Yes
No c
Don't Know
c

A-26 In the past 12 months, have you or a family member in your household required immediate 24 hour health care services for a medical emergency? c Yes

c No → **If No, go to question A-30.**

c Don't know

A-27 In the past 12 months, did you ever experience any difficulties getting immediate 24 hour health care services for a medical emergency for yourself c or a family member in your household?

Yes

c No

c Don't know

A-28 How far do you travel to receive routine and ongoing medical care?_____ Km

A-29 How far do you travel to receive 24 hour emergency health care services?_____ Km

A-30 How far do you travel to receive medical or surgical specialist services?_____ Km

A-31 On average, how long does it take for an ambulance to arrive at your home in an emergency? _____minutes c Don't Know

OUTDOOR ENVIRONMENT

A-32 Do you have an indoor (barn) intensive livestock operation (building) located near your home?

c Yes → **If Yes, how far?**

c Within 1/4 mile c Greater than 1/4 mile c No

c Don't know

A-33 Do you have an outdoor feedlot or corrals located near your home?

c Yes → **If Yes, how far?**

c Within 1/4 mile c Greater than 1/4 mile c No

c Don't know

A-34 Do you have a balestack or bales located near your home?

c Yes → **If Yes, how far?**

c Within 1/4 mile c Greater than 1/4 mile c No

c Don't know

A-35 Do you have grain bins located near your home?

c Yes → **If Yes, how far?**

c Within 1/4 mile c Greater than 1/4 mile

c No

c Don't know

A-36 Do you have a sewage pond or manure lagoon located near your home?

c Yes → **If Yes, how far?**

c Within 1/4 mile c Greater than 1/4 mile

c No

c Don't know

A-37 What is the **main** source of the water supply for drinking purposes in your home?

c Bottled water
c Deep well water (more than 100 ft)
c Shallow well water (less than 100 ft)
c Spring, river or creek
c Dugout, reservoir
c Lake
c Other source:
Please specify_____

PLEASE COMPLETE THIS SECTION IF YOU LIVE ON A FARM.

FARM DEMOGRAPHICS

A-38 From the list below, please check each commodity that is produced for sale on your farm or ranch **(Please check all that apply).**

c Grain crops
c Cattle (beef)
c Cattle (dairy)
c Pigs
c Poultry
c Vegetable/Fruit
c Other:
Please specify_____

A-39 What is the area of land in your operation that you farmed or ranched last growing season? **(Please exclude land rented to others).**

Grain crops	___ acres
Forage crops	___ acres
Pasture	___ acres
Summerfallow	___ acres
Other	___ acres

A-40 How many of these types of livestock are typically raised on your farm?

No livestock	c
Cattle (beef)	____ number
Cattle (dairy)	____ number
Pigs	____ number
Poultry	____ number
Other	____ number

THIS CONCLUDES SECTION A. PLEASE PROCEED TO SECTION B, ADULT 1(GREEN TAB).

SECTION B INDIVIDUAL QUESTIONS

WE WOULD LIKE TO KNOW ABOUT EACH ADULT FAMILY MEMBER (18 YEARS OR OVER) LIVING IN YOUR HOUSEHOLD. IN THIS BOOKLET, WE HAVE INCLUDED SPACE FOR 2 ADULTS.

IF YOU HAVE MORE THAN 2 ADULT FAMILY MEMBERS LIVING IN YOUR HOME, PLEASE COMPLETE "Section B" IN THE GREEN BOOKLET FOR EACH ADDITIONAL ADULT.

Adult 1

ADULT 1

NOW, PLEASE ANSWER THE FOLLOWING QUESTIONS ABOUT ADULT # 1.

B-1 Age as of January 1st, 2010: _____

B-2 Date of birth: MM_____ DD____ YY_____

B-3 Sex: Male c Female c

B-4 Highest level of education:

- c Less than high school
- c Completed high school
- c Completed university
- c Completed post-secondary education other than above

B-5 What is your ethnic background?

- c Caucasian
- c First Nation
- c Metis
- c Other → **Please specify:** _____

B-6 What is your height? _____cm. **OR** _____ft and in.

B-7 What is your weight? _____Kg. **OR** _____lbs

B-8 What is your marital status? **(Please check only one)**

- c Married
- c Common law/living together
- c Widowed
- c Divorced/separated
- c Single, never married

RESPIRATORY HEALTH

COUGH

B-9 Do you usually have a cough?

- c Yes
- c No → **If no, go to question B-12.**

B-10 Do you usually cough like this on most days for 3 consecutive months or more during the year?

- c Yes
- c No

B-11 For how many years have you had this cough?

_____ years

PHLEGM

B-12 Do you usually bring up phlegm from your chest? c Yes

c No → **If no, go to question B-15.**

B-13 Do you bring up phlegm like this on most days for 3 consecutive months or more during the year?

- c Yes
- c No

B-14 For how many years have you had trouble with phlegm?

_____ years

WHEEZE

B-15 Does your chest ever sound wheezy or whistling:

	Yes	No
1. When you have a cold?	c	c
2. Apart from colds?	c	c
3. Most days or nights?	c	c

If YES to 1, 2, OR 3, for how many years has this been present? _____number of years

B-16 Have you ever had an attack of wheezing that has made you feel short of breath?

- c Yes
- c No

If YES, have you ever required medicine or treatment for the(se) attack(s)?

- c Yes
- c No

BREATHLESSNESS

B-17 Are you troubled by shortness of breath when hurrying on the level or walking up a slight hill?

- c Yes
- c No

B-18 Do you have to walk slower than people of your age because of breathlessness?

- c Yes
- c No

B-19 Do you ever have to stop for breath when walking at your own pace on the level?

- c Yes
- c No

B-20 Do you ever have to stop for breath after walking about 100 yards (or after a few minutes) on the level?

c Yes

c No

B-21 Are you too breathless to leave the house or breathless on dressing or undressing?

c Yes

c No

ASTHMA

B-22 Have you ever had asthma? c Yes

c No → **If no, go to question B-26.**

B-23 **If Yes to B-22:**

Do you still have it? c Yes c No
Was it confirmed by a doctor? c Yes c No

At what age did it start? ____ age in years

If you no longer have it, at what age did it stop? ____ age in years

B-24 **If yes to B-22**, how many times have you required services for asthma from the following places during the past 12 months?

Hospital inpatient: _____ times
Emergency room outpatient: _____ times
Doctor's office: _____ times

B-25 **If yes to B-22,** which of the following statements best describes your asthma medication use in the past 12 months:

c Never in the past 12 months
c At least once in the past 12 months
c At least once per month
c At least once per week
c Every day

ALLERGIES

B-26 Have you ever had an allergic reaction to any of the following: **(Please check all that apply).**

1. House dust c Yes c No
2. Cats c Yes c No
3. Dogs c Yes c No
4. Grasses c Yes c No
5. Pollens c Yes c No
6. Molds c Yes c No
7. Others, c Yes c No

Please specify:_____

PHYSICAL ACTIVITY

B-27 Do you exercise?

c Yes → **If yes, how many times a week?** _____times a week

c No → **If no, go to question B-29.**

B-28 How long do you usually exercise?

c Less than 15 minutes
c 15 to 30 minutes
c 31 to 60 minutes
c More than 60 minutes
c Don't Know

B-29 In a **typical week** in the past **3 months**, how much time did you usually spend on a computer, including playing computer games and using the Internet or World Wide Web? **(Please do not include time spent at work or at school)**

c None
c Less than 1 hour
c From 1 to 2 hours
c From 3 to 5 hours
c From 6 to 10 hours
c From 11 to 14 hours
c From 15 to 20 hours
c More than 20 hours

B-30 In a **typical week** in the past **3 months**, how much time did you usually spend watching television or videos?

c None
c Less than 1 hour
c From 1 to 2 hours
c From 3 to 5 hours
c From 6 to 10 hours
c From 11 to 14 hours
c From 15 to 20 hours
c More than 20 hours

EARLY LIFE EXPOSURES

B-31 Have you ever lived on a farm?

c Yes

c No

c Don't know

B-32 Did you live on a farm during your first year of life?

c Yes → **If yes, what type of farm? (Check all that apply)**

c Grain
c Livestock

c No

c Don't know

B-33 Did your mother smoke while she was pregnant with you?

c Yes

c No

c Don't know

B-34 What was your birth weight?
_____ pounds or _____ grams

c Don't know

B-35 Were you breastfed as a child?

c Yes → **If yes, was it for 6 months or longer?** c Yes c No

c No

c Don't know

CIGARETTE SMOKING

B-36 Have you ever smoked cigarettes? **(If you have smoked less than 20 packs of cigarettes in your lifetime, answer no.)**

c Yes

c No → **If no, go to question B-43**

B-37 Do you now smoke cigarettes?

c Yes

c No

B-38 How old were you when you first started regular cigarette smoking? ____ years old

B-39 How many cigarettes do you smoke per day now?_____ cigarettes per day

B-40 On the average of the entire time you smoked, how many cigarettes did you smoke per day?
_____ cigarettes per day

B-41 If you have stopped smoking cigarettes completely, how old were you when you stopped?
_____ age stopped

B-42 If there have been periods when you abstained from smoking, indicate total years of abstinence from smoking. _____ years

B-43 Have you ever smoked a pipe regularly? **(Yes means more than 12 oz of tobacco in a lifetime)**

c Yes

c No

B-44 Have you ever smoked cigars regularly? **(Yes means more than 1 cigar a week for a year)**

c Yes

c No

B-45 Do you smoke a pipe or cigars regularly at present?

c Yes

c No

ALCOHOL CONSUMPTION

B-46 During the past 12 months, how often did you drink alcoholic beverages?

c Never
c Less than once a month
c Once a month
c 2 to 3 times a month
c Once a week
c 2 to 3 times a week
c 4 to 6 times a week
c Every day

B-47 How often in the past 12 months have you had 5 or more drinks on one occasion?

c Never
c Less than once a month
c Once a month
c 2 to 3 times a month
c Once a week
c More than once a week

MEDICAL HISTORY

B-48 In general would you say your health is:

c Excellent
c Very Good
c Good
c Fair
c Poor

B-49 During the <u>past 12 months</u>, were you seen by a doctor or other primary care giver for:

	Yes	No	Don't know
Stomach acidity or reflux?	c	c	c
An ear infection?	c	c	c
An injury?	c	c	c

B-50 Has a doctor or primary care giver ever said you have:

	Yes	No	Don't Know
Diabetes	c	c	c
Heart Disease	c	c	c
Heart Attack	c	c	c
Hardening of the arteries	c	c	c
High Blood Pressure	c	c	c
Cystic Fibrosis	c	c	c
Tuberculosis	c	c	c
Stroke	c	c	c
Cancer	c	c	c

If yes to cancer, please specify type(s):

_____

_____

CHEST ILLNESSES

B-51 Has a doctor ever said you had any of the following chest illnesses:

	Chest Illness	During the Past 12 Months		Ever In Your Life	
a.	Attack of bronchitis	c Yes	c No	c Yes	c No
b.	Pneumonia	c Yes	c No	c Yes	c No
c.	Hay Fever	c Yes	c No	c Yes	c No
d.	Sinus Trouble	c Yes	c No	c Yes	c No
e.	Chronic Bronchitis	c Yes	c No	c Yes	c No
f.	Emphysema	c Yes	c No	c Yes	c No
g.	COPD (Chronic Obstructive Pulmonary Disease)	c Yes	c No	c Yes	c No
h.	Sleep Apnea	c Yes	c No	c Yes	c No
i.	Other Chest Illness (Example chest operation) please specify:	c Yes	c No	c Yes	c No

B-52 **If yes to Chronic Obstructive Pulmonary Disease (COPD) in question B-51g,** how many times have you required services for COPD from the following places during the **past 12 months**?

Hospital inpatient: _____ times

Emergency room outpatient: _____ times

Doctor's office: _____ times

REST AND SLEEP

B-53 Do you snore?

c Yes

c No → **If no, go to question B-55.**

c Don't know

B-54 If you snore, is your snoring:

c Slightly louder than breathing?

c As loud as talking?

c Louder than talking?

c Very loud - can be heard in adjacent rooms?

B-55 How likely are you to doze off or fall asleep in the situations described below, in contrast to just feeling tired? This refers to your usual way of life in recent times. Even if you haven't done some of these things recently, try to work out how they would have affected you. **Please check one response choice for each situation.**

SITUATION	RESPONSE CHOICES			
	Would never doze	Slight chance of dozing	Moderate chance of dozing	High chance of dozing
Sitting and reading	c	c	c	c
Watching TV	c	c	c	c
Sitting inactive in a public place (e.g., a theatre or a meeting)	c	c	c	c
As a passenger in a car for an hour without a break	c	c	c	c
Lying down to rest in the afternoon when circumstances permit	c	c	c	c
Sitting and talking to someone	c	c	c	c
Sitting quietly after lunch without alcohol	c	c	c	c
In a car, while stopped for a few minutes in the traffic	c	c	c	c

FAMILY HISTORY

B-56 Have the following members of your biological family ever had:

	FATHER			MOTHER			BROTHER/SISTER		
	Yes	No	Don't Know	Yes	No	Don't Know	Yes	No	Don't Know
Diabetes	c	c	c	c	c	c	c	c	c
Heart Disease	c	c	c	c	c	c	c	c	c
Heart Attack	c	c	c	c	c	c	c	c	c
Hardening of the arteries	c	c	c	c	c	c	c	c	c
High Blood Pressure	c	c	c	c	c	c	c	c	c
Cystic Fibrosis	c	c	c	c	c	c	c	c	c
Tuberculosis	c	c	c	c	c	c	c	c	c
Stroke	c	c	c	c	c	c	c	c	c
Lung Trouble (Asthma,Emphysema, Chronic Bronchitis)	c	c	c	c	c	c	c	c	c
Cancer	c	c	c	c	c	c	c	c	c
If yes to cancer, please specify type(s):	_____			_____			_____		

OCCUPATIONAL HISTORY

B-57 Please list all full-time jobs at which you have worked for at least one year, starting with your present or most recent job. Please state the job title and business as specifically as possible. For example, 'mixed farming' instead of 'farming'.

Job Title	Business, Industry or Service	Total number of Years at job
e.g. Nurse	Health Care	10
e.g. Farmer	Mixed Farming	30

B-58 Have you ever been exposed to any of the following in the work place?

	No	Yes	If Yes, how often?	How many years?
Grain Dust	c	c	Daily c Weekly c Monthly c Occasionally c	
Mine dust (e.g. potash, uranium) Specify _____	c	c	Daily c Weekly c Monthly c Occasionally c	
Asbestos dust	c	c	Daily c Weekly c Monthly c Occasionally c	
Wood dust	c	c	Daily c Weekly c Monthly c Occasionally c	
Other dust Specify _____	c	c	Daily c Weekly c Monthly c Occasionally c	
Livestock	c	c	Daily c Weekly c Monthly c Occasionally c	
Smoke from stubble burning	c	c	Daily c Weekly c Monthly c Occasionally c	
Diesel fumes	c	c	Daily c Weekly c Monthly c Occasionally c	
Welding fumes	c	c	Daily c Weekly c Monthly c Occasionally c	
Solvent fumes	c	c	Daily c Weekly c Monthly c Occasionally c	
Oil / Gas well fumes	c	c	Daily c Weekly c Monthly c Occasionally c	
Herbicides (to kill plants)	c	c	Daily c Weekly c Monthly c Occasionally c	
Fungicides (to treat grain)	c	c	Daily c Weekly c Monthly c Occasionally c	
Insecticides (to kill insects)	c	c	Daily c Weekly c Monthly c Occasionally c	
Molds	c	c	Daily c Weekly c Monthly c Occasionally c	
Radiation	c	c	Daily c Weekly c Monthly c Occasionally c	
Other, Specify _____	c	c	Daily c Weekly c Monthly c Occasionally c	

B-59 How often do you (did you) wear a dust mask when exposed to grain dust?

c Always c Most of the time c Sometimes c Never

B-60 We wish to find out more about respiratory health of rural people. Would you be willing to be contacted about having breathing and/or allergy tests at a nearby location?

c Yes

c No

c I would like more information

IF THERE IS ONLY ONE ADULT IN YOUR FAMILY, PLEASE SKIP TO THE LAST PAGE.

IF THERE IS ANOTHER ADULT IN YOUR FAMILY, PLEASE CONTINUE ON THE NEXT PAGE.

REMEMBER TO COMPLETE THE CONTACT INFORMATION ON THE LAST PAGE!
(THIS INFORMATION WILL BE REMOVED FROM YOUR QUESTIONNAIRE TO ENSURE CONFIDENTIALITY.)

SECTION B INDIVIDUAL QUESTIONS

ADULT 2

NOW, PLEASE ANSWER THE FOLLOWING QUESTIONS ABOUT ADULT # 2.

B-1 Age as of January 1st, 2010: _____

B-2 Date of birth: MM_____ DD____ YY_____

B-3 Sex: Male c Female c

B-4 Highest level of education:

- c Less than high school
- c Completed high school
- c Completed university
- c Completed post-secondary education other than above

B-5 What is your ethnic background?

- c Caucasian
- c First Nation
- c Metis
- c Other → **Please specify:** _____

B-6 What is your height? _____cm. **OR** _____ft and in.

B-7 What is your weight? _____Kg. **OR** _____lbs

B-8 What is your marital status? **(Please check only one)**

- c Married
- c Common law/living together
- c Widowed
- c Divorced/separated
- c Single, never married

RESPIRATORY HEALTH

COUGH

B-9 Do you usually have a cough?

- c Yes
- c No → **If no, go to question B-12.**

B-10 Do you usually cough like this on most days for 3 consecutive months or more during the year?

- c Yes
- c No

B-11 For how many years have you had this cough?

_____ years

PHLEGM

B-12 Do you usually bring up phlegm from your chest? c Yes

c No → **If no, go to question B-15.**

B-13 Do you bring up phlegm like this on most days for 3 consecutive months or more during the year?

- c Yes
- c No

B-14 For how many years have you had trouble with phlegm?

_____ years

WHEEZE

B-15 Does your chest ever sound wheezy or whistling:

	Yes	No
1. When you have a cold?	c	c
2. Apart from colds?	c	c
3. Most days or nights?	c	c

If YES to 1, 2, OR 3, for how many years has this been present? _____number of years

B-16 Have you ever had an attack of wheezing that has made you feel short of breath?

- c Yes
- c No

If YES, have you ever required medicine or treatment for the(se) attack(s)?

- c Yes
- c No

BREATHLESSNESS

B-17 Are you troubled by shortness of breath when hurrying on the level or walking up a slight hill?

- c Yes
- c No

B-18 Do you have to walk slower than people of your age because of breathlessness?

- c Yes
- c No

B-19 Do you ever have to stop for breath when walking at your own pace on the level?

- c Yes
- c No

Adult 2

B-20 Do you ever have to stop for breath after walking about 100 yards (or after a few minutes) on the level?

c Yes

c No

B-21 Are you too breathless to leave the house or breathless on dressing or undressing?

c Yes

c No

ASTHMA

B-22 Have you ever had asthma? c Yes

c No → **If no, go to question B-26.**

B-23 **If Yes to B-22:**

Do you still have it? c Yes c No
Was it confirmed by a doctor? c Yes c No

At what age did it start? ____ age in years

If you no longer have it, at what age did it stop? ____ age in years

B-24 **If yes to B-22**, how many times have you required services for asthma from the following places during the past 12 months?

Hospital inpatient: _____ times
Emergency room outpatient: _____ times
Doctor's office: _____ times

B-25 **If yes to B-22,** which of the following statements best describes your asthma medication use in the past 12 months:

c Never in the past 12 months
c At least once in the past 12 months
c At least once per month
c At least once per week
c Every day

ALLERGIES

B-26 Have you ever had an allergic reaction to any of the following: **(Please check all that apply).**

1. House dust c Yes c No
2. Cats c Yes c No
3. Dogs c Yes c No
4. Grasses c Yes c No
5. Pollens c Yes c No
6. Molds c Yes c No
7. Others, c Yes c No

Please specify:_____

PHYSICAL ACTIVITY

B-27 Do you exercise?

c Yes → **If yes, how many times a week?** _____times a week

c No → **If no, go to question B-29.**

B-28 How long do you usually exercise? c Less than 15 minutes

c 15 to 30 minutes c 31 to 60 minutes

c More than 60 minutes c Don't Know

B-29 In a **typical week** in the past **3 months**, how much time did you usually spend on a computer, including playing computer games and using the Internet or World Wide Web? **(Please do not include time spent at work or at school)**

c None
c Less than 1 hour
c From 1 to 2 hours
c From 3 to 5 hours
c From 6 to 10 hours
c From 11 to 14 hours
c From 15 to 20 hours
c More than 20 hours

B-30 In a **typical week** in the past **3 months**, how much time did you usually spend watching television or videos?

c None
c Less than 1 hour
c From 1 to 2 hours
c From 3 to 5 hours
c From 6 to 10 hours
c From 11 to 14 hours
c From 15 to 20 hours
c More than 20 hours

EARLY LIFE EXPOSURES

B-31 Have you ever lived on a farm?

c Yes

c No

c Don't know

B-32 Did you live on a farm during your first year of life?

c Yes → **If yes, what type of farm? (Check all that apply)**

c Grain
c Livestock

c No

c Don't know

B-33 Did your mother smoke while she was pregnant with you?

c Yes

c No

c Don't know

Adult 2

B-34 What was your birth weight?
_____ pounds or _____ grams

c Don't know

B-35 Were you breastfed as a child?

c Yes → **If yes, was it for 6 months or longer?** c Yes c No

c No

c Don't know

CIGARETTE SMOKING

B-36 Have you ever smoked cigarettes? **(If you have smoked less than 20 packs of cigarettes in your lifetime, answer no.)**

c Yes

c No → **If no, go to question B-43**

B-37 Do you now smoke cigarettes?

c Yes

c No

B-38 How old were you when you first started regular cigarette smoking? ____ years old

B-39 How many cigarettes do you smoke per day now?_____ cigarettes per day

B-40 On the average of the entire time you smoked, how many cigarettes did you smoke per day?
_____ cigarettes per day

B-41 If you have stopped smoking cigarettes completely, how old were you when you stopped?
_____ age stopped

B-42 If there have been periods when you abstained from smoking, indicate total years of abstinence from smoking. _____ years

B-43 Have you ever smoked a pipe regularly? **(Yes means more than 12 oz of tobacco in a lifetime)**

c Yes

c No

B-44 Have you ever smoked cigars regularly? **(Yes means more than 1 cigar a week for a year)**

c Yes

c No

B-45 Do you smoke a pipe or cigars regularly at present?

c Yes

c No

ALCOHOL CONSUMPTION

B-46 During the past 12 months, how often did you drink alcoholic beverages?

c Never
c Less than once a month
c Once a month
c 2 to 3 times a month
c Once a week
c 2 to 3 times a week
c 4 to 6 times a week
c Every day

B-47 How often in the past 12 months have you had 5 or more drinks on one occasion?

c Never
c Less than once a month
c Once a month
c 2 to 3 times a month
c Once a week
c More than once a week

MEDICAL HISTORY

B-48 In general would you say your health is:

c Excellent
c Very Good
c Good
c Fair
c Poor

B-49 During the <u>past 12 months</u>, were you seen by a doctor or other primary care giver for:

	Yes	No	Don't know
Stomach acidity or reflux?	c	c	c
An ear infection?	c	c	c
An injury?	c	c	c

B-50 Has a doctor or primary care giver ever said you have:

	Yes	No	Don't Know
Diabetes	c	c	c
Heart Disease	c	c	c
Heart Attack	c	c	c
Hardening of the arteries	c	c	c
High Blood Pressure	c	c	c
Cystic Fibrosis	c	c	c
Tuberculosis	c	c	c
Stroke	c	c	c
Cancer	c	c	c

If yes to cancer, please specify type(s):

_____

_____

Adult 2

CHEST ILLNESSES

B-51 Has a doctor ever said you had any of the following chest illnesses:

	Chest Illness	During the Past 12 Months		Ever In Your Life	
a.	Attack of bronchitis	c Yes	c No	c Yes	c No
b.	Pneumonia	c Yes	c No	c Yes	c No
c.	Hay Fever	c Yes	c No	c Yes	c No
d.	Sinus Trouble	c Yes	c No	c Yes	c No
e.	Chronic Bronchitis	c Yes	c No	c Yes	c No
f.	Emphysema	c Yes	c No	c Yes	c No
g.	COPD (Chronic Obstructive Pulmonary Disease)	c Yes	c No	c Yes	c No
h.	Sleep Apnea	c Yes	c No	c Yes	c No
i.	Other Chest Illness (Example chest operation) please specify:	c Yes	c No	c Yes	c No

B-52 **If yes to Chronic Obstructive Pulmonary Disease (COPD) in question B-51g,** how many times have you required services for COPD from the following places during the **past 12 months**?

Hospital inpatient: _____ times

Emergency room outpatient: _____ times

Doctor's office: _____ times

REST AND SLEEP

B-53 Do you snore?

c Yes

c No → **If no, go to question B-55.**

c Don't know

B-54 If you snore, is your snoring:

c Slightly louder than breathing?

c As loud as talking?

c Louder than talking?

c Very loud - can be heard in adjacent rooms?

B-55 How likely are you to doze off or fall asleep in the situations described below, in contrast to just feeling tired? This refers to your usual way of life in recent times. Even if you haven't done some of these things recently, try to work out how they would have affected you. **Please check one response choice for each situation.**

SITUATION	RESPONSE CHOICES			
	Would never doze	Slight chance of dozing	Moderate chance of dozing	High chance of dozing
Sitting and reading	c	c	c	c
Watching TV	c	c	c	c
Sitting inactive in a public place (e.g., a theatre or a meeting)	c	c	c	c
As a passenger in a car for an hour without a break	c	c	c	c
Lying down to rest in the afternoon when circumstances permit	c	c	c	c
Sitting and talking to someone	c	c	c	c
Sitting quietly after lunch without alcohol	c	c	c	c
In a car, while stopped for a few minutes in the traffic	c	c	c	c

FAMILY HISTORY

B-56 Have the following members of your biological family ever had:

	FATHER			MOTHER			BROTHER/SISTER		
	Yes	No	Don't Know	Yes	No	Don't Know	Yes	No	Don't Know
Diabetes	c	c	c	c	c	c	c	c	c
Heart Disease	c	c	c	c	c	c	c	c	c
Heart Attack	c	c	c	c	c	c	c	c	c
Hardening of the arteries	c	c	c	c	c	c	c	c	c
High Blood Pressure	c	c	c	c	c	c	c	c	c
Cystic Fibrosis	c	c	c	c	c	c	c	c	c
Tuberculosis	c	c	c	c	c	c	c	c	c
Stroke	c	c	c	c	c	c	c	c	c
Lung Trouble (Asthma,Emphysema, Chronic Bronchitis)	c	c	c	c	c	c	c	c	c
Cancer If yes to cancer, please specify type(s):	c _____	c	c	c _____	c	c	c _____	c	c

OCCUPATIONAL HISTORY

B-57 Please list all full-time jobs at which you have worked for at least one year, starting with your present or most recent job. Please state the job title and business as specifically as possible. For example, 'mixed farming' instead of 'farming'.

Job Title	Business, Industry or Service	Total number of Years at job
e.g. Nurse	Health Care	10
e.g. Farmer	Mixed Farming	30

Adult 2

B-58 Have you ever been exposed to any of the following in the work place?

	No	Yes	If Yes, how often?	How many years?
Grain Dust	c	c	Daily c Weekly c Monthly c Occasionally c	
Mine dust (e.g. potash, uranium) Specify _____	c	c	Daily c Weekly c Monthly c Occasionally c	
Asbestos dust	c	c	Daily c Weekly c Monthly c Occasionally c	
Wood dust	c	c	Daily c Weekly c Monthly c Occasionally c	
Other dust Specify _____	c	c	Daily c Weekly c Monthly c Occasionally c	
Livestock	c	c	Daily c Weekly c Monthly c Occasionally c	
Smoke from stubble burning	c	c	Daily c Weekly c Monthly c Occasionally c	
Diesel fumes	c	c	Daily c Weekly c Monthly c Occasionally c	
Welding fumes	c	c	Daily c Weekly c Monthly c Occasionally c	
Solvent fumes	c	c	Daily c Weekly c Monthly c Occasionally c	
Oil / Gas well fumes	c	c	Daily c Weekly c Monthly c Occasionally c	
Herbicides (to kill plants)	c	c	Daily c Weekly c Monthly c Occasionally c	
Fungicides (to treat grain)	c	c	Daily c Weekly c Monthly c Occasionally c	
Insecticides (to kill insects)	c	c	Daily c Weekly c Monthly c Occasionally c	
Molds	c	c	Daily c Weekly c Monthly c Occasionally c	
Radiation	c	c	Daily c Weekly c Monthly c Occasionally c	
Other, Specify _____	c	c	Daily c Weekly c Monthly c Occasionally c	
How often do you (did you) wear a dust mask when exposed to grain dust?				

B-59

c Always c Most of the time c Sometimes c Never

B-60 We wish to find out more about respiratory health of rural people. Would you be willing to be contacted about having breathing and/or allergy tests at a nearby location?

c Yes

c No

c I would like more information

IF THERE ARE MORE THAN TWO ADULT FAMILY MEMBERS LIVING IN YOUR HOUSEHOLD,

PLEASE CONTINUE IN THE GREEN BOOKLET.

REMEMBER TO COMPLETE THE CONTACT INFORMATION ON THE LAST PAGE!

(THIS INFORMATION WILL BE REMOVED FROM YOUR QUESTIONNAIRE TO ENSURE CONFIDENTIALITY.)

CONTACT INFORMATION (PLEASE PRINT)

NAME:_____ Age: _____ c Male c Female

(Name of person completing the survey)

_____

Address (number and street and Box Number)

_____ , _____

Town Postal code

If you live on a farm give the land location of your residence.

_____

Land location (quarter, section, township, meridian)

Telephone Numbers **(check most preferred):**

Work _____ c

Home _____ c

Cell _____ c

THIS IS THE END OF THE SURVEY.

THANK YOU VERY MUCH FOR YOUR HELP!